Technology, Public Policy, and the Changing Structure of American Agriculture

Volume II—Background Papers

Part D: Rural Communities

1. Agribusiness and the Small Community
2. Report on the Structure of Agriculture and Impacts of New Technologies on Rural Communities in Arizona, California, Florida, and Texas
3. Emerging Agricultural Technologies, Farm Size, Public Policy, and Rural Communities: The Great Plains and the West
4. Emerging Agricultural Technologies, Farm Structural Change, Public Policy, and Rural Communities in the Northeast
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6. Agricultural Technologies, Farm Structure, and Rural Communities in the Cornbelt: Policy Choices and Implications for 2000

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3. Emerging Agricultural Technologies, Farm Size, Public Policy, and Rural Communities: The Great Plains and the West by Jan L. Flora and Cornelia Butler Flora
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6. Agricultural Technologies, Farm Structure, and Rural Communities in the Cornbelt: Policy Choices and Implications for 2000 by J.C. van Es, David L. Chicoine, and Mark A. Flotow

Background Paper No. 1

Agribusiness and the Small Community

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AGRIBUSINESS AND THE SMALL COMMUNITY

by

Dean MacCannell

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Abstract: This paper examines two problems facing small communities surrounded by large-scale agriculture: (1) the emerging opposition of social and economic interests dividing agribusiness and the rural community, and (2) the lack of articulation of social programs to rural areas. It is argued that these underlying problems, where they occur, result in a wide range of negative social conditions. Specific documentation is provided from the California central valley, but it is suggested that the trends described potentially have wider national significance and require federal-level solutions.

The Emerging Opposition of Agribusiness and the Rural Community:

Policy makers in the United States are used to thinking in terms of an opposition of interest between large-scale industry and the human community, but this same kind of understanding does not characterize thought about the rural sector and the agricultural economy. And, indeed, in those times and places where the family farm prevailed as the main economic unit, there seemed to be very little reason to think in terms of such an opposition. Before World War II, virtually any policy designed to strengthen agriculture would indirectly benefit workers as well as growers, and the rural community and rural non-farm populations as well. It was possible, then, to assume that programs designed to provide economic benefits to agriculture would have positive social effects in the rural areas and vice versa. The main concern at that time was appropriate levels of trade-off against urban programs. With the decline of the family farm system in many areas of the country, the conditions which favor unified agricultural and rural policies no longer exist in many of the agricultural areas of America. The increasing presence of large-scale agriculture in and near the small community is transforming the community into the opposite of its ideal image. In the place of towns which could accurately be characterized as providing their residents with a clean and healthy environment, a great deal of social equality and local autonomy, we find agricultural pollution, labor practices that lead to increasing social inequality, restricted opportunity to obtain land and start new enterprise, and the suppression of the development of a local middle class and the businesses and services demanded and supported by such a class. Accelerating concentration of land and capital within agriculture during the last 25 years has produced a new and clear division within the rural sector: namely policies which benefit large-scale agricultural business do not automatically improve the life of agricultural laborers and rural non-farm peoples. In fact, there is mounting evidence that current policies designed to promote agriculture, insofar as they lead to the expansion of existing operations and greater concnetration, in actual practice, also promote the deterioriation of rural community life.

Research of the Macrosocial Accounting Project at the University of California at Davis shows that the proportion of the population living at or below the federal poverty standard is significantly correlated with measures of farm size and agricultural production. At the county level, taking into consideration the entire population of the state, both rural and urban, the correlation between proportion of acreage in corporate farms with expenses of over $40,000/year and family poverty is .47 (Pearson's R, 1975 data). The strength of the correlation doubles when only rural census tracts are considered.

These, and similar, correlations suggest that the findings of Walter Goldschmidt's (1944) comparison of two California central valley towns are still relevant. Following Goldschmidt's lead, researchers at Davis have recently undertaken diverse retests of Goldschmidt's findings using current data. In a recent case analysis of five communities in and near the Westlands Water District, we have found high levels of poverty and inequality embedded in the context of the nation's richest and most heavily subsidized farms. The Westlands is an area of about 215 farms on one-half million acres. These farms together produce $300 million annual sales. There are ten small towns in the Westlands. The commercial and social life of these communities revolves entirely around the major farming operations of the District. We have found the incidence of poverty in these towns to range between 21.5 percent and 28.9 percent of the total population. For the Mexican-American majority, the proportion of the population living at or below the federal poverty standard ranges from 24.6 to 53.7 percent. These poverty figures compare to 15 percent for other adjacent rural areas, and seven percent for the state as a whole.

Other social indicators reflect a similar pattern of data. For example, in the area of housing, ten percent of the homes in the Westlands lack plumbing, compared to 3.4 percent for the other rural communities of the region. Over 12 percent of the population of the Westlands live in homes with more than 1.5 persons per room. The same figure for the other nearby rural areas is five percent. In one of the Westlands towns, the crowding figure for Mexican-Americans is 43 percent. The only statistic which does not reflect this pattern of community deterioriation is employment which, in the Westlands, is always high, often approaching 100 percent.

The relationship between agribusiness and negative social conditions in the small community are not merely a "Western pattern." Even though the concrete historical conditions are quite different from place to place, the underlying relationships reappear in other areas of the United States. This can be illustrated by a limited regional review.

The South: In the American South, the relationship between farm size and concentration in agriculture and social conditions in the rural community is complicated by race relations and a history of having lost a war that was fought, in part, over issues related to farm size and farm labor policies. The original plantation system of the south, with its very large farms of tobacco, rice, indigo, sugar and cotton, was eventually supplanted by a system of smaller farms, an important percentage of which has been traditionally operated by tenant farmers, many of whom are the descendants of slaves. During the last 25 years, there have been increases in average farm size, and an evident shift away from the tenant farm pattern. Between 1950 and 1970, blacks and other minorities in the rural farm population of the south declined from 16 to 10 percent. According to Marshall (1974:23) "the number of black operated farms in the south declined from 183,638 in 1964 to 84,469 in 1969, or a decline of 53.8 percent, as compared with a total decline of only 14.8 percent." Marshall continues, "fewer white farmers are now farming much more land whereas for blacks, both the number of farms and the acreage have declined." The blacks who have continued to farm have been forced to supplement their incomes with off-farm work to a much greater degree than before. In 1967, the Office of Economic Opportunity sponsored a survey which showed that displaced southern rural blacks either migrated to urban areas or stayed behind in the small rural communities: of these, 16 percent of the adults who stayed in the rural areas had a high school education compared to 26 percent for the rural-to-urban migrants. The incidence of poverty for those blacks staying behind in the rural communities in 1969 was 57.7 percent, compared to 26.6 percent for the rural-to-urban migrants. These figures bear an interesting resemblance to the statistics for the Mexican-American population of the Westlands Water District as compared to the minority populations of Fresno and the other California valley cities.

The agricultural re-concentration of the south is driving minorities off the land into rural non-farm work and into the small rural communities where they are forming pockets of poverty, ignorance and sickness. These problems are becoming genuine burdens for the small community, and for middleclass tax payers in nonfarm areas, not merely in the South and West, but nationally.

The Midwest: Midwestern rural communities are different from communities in the American South and West in almost every respect except that many of the problems they currently face can also be traced to increasing farm size and land and capital concentration in agriculture. The communities of the American Midwest were originally predominantly middle class and professional and functioned as service and market centers for the surrounding locally owned and operated farms. Studies by Thomas (1960) and Stafford (1963) indicate that the number of businesses and services found in small towns in Iowa and Nebraska is much greater per unit of population than in other areas of the United States. Comparing Thomas' findings with those of a similar study by Paul Marr (1968) of California central valley communities, we discover that the Midwestern communities have twice as many businesses and services percapita than their Western counterparts. In short, Midwestern communities are dependent on a hinterland which is densely populated with people who have time and money to spend in the towns.

While the nature of their vulnerability is quite different from the communities in the other regions of the United States, Midwestern towns are equally at risk from increasing concentration of farm ownership. Even as ownership remains local and labor remains in the family unit, decreasing the number of farms in the region erodes the support base for the communities which can rapidly become overextended. Some of the businesses stagnate and collapse while others move into the larger regional centers, vitiating the infrastructure of the small rural community.

The relationship of farm ownership concentration to community infrastructure deterioriation in the Midwest and other regions of the United States is exacerbated by the fact that larger farm sizes require less labor input per acre. Rodefeld (1974:248) has shown, for example, that on larger corporate farms in Wisconsin, each man-year equivalent accounted for 20 crop acres more than on smaller owner-operated farms. Rodefeld's study contains several specific examples of the ways large-scale agribusiness' needs for efficiency are opposed to the rural community's need for an adequate population to support the provision of basic goods and services. While the history and the specific issues are different, the current problems facing the small midwestern community have the same roots in agricultural concentration.

Summary of the Agribusiness/Small Community Opposition: Everyone who has done careful research on farm size, residency of agricultural land owners and social conditions in the rural community finds the same relationship: as farm size and absentee ownership increases, social conditions in the local community deteriorate. In our own studies, we have found depressed median family incomes, high levels of poverty, low education levels, social and economic inequality between ethnic groups, etc., associated with land and capital concentration in agriculture. Of course this deterioriation is accompanied by increasing wealth for a few farmers who understandably have real difficulty seeing the emerging general problem as their own personal situations improve.

Communities that are surrounded by farms that are larger than can be operated by a family unit have a bi-modal income distribution with a few wealthy elites, a majority of poor laborers, and virtually no middle class. The absense of a middle class at the community level has a serious negative effect on both the quality and quantity of social and commercial services, public education, local governments, etc. Rothman *et al.* (1977) find that hired agricultural laborers are always located at the bottom of the community status hierarchy, are always transient to some degreee even if not technically migratory, and are neve treated as full-fledged members of the rural community. On the other hand, the large-scale farm owner-operators tend to bypass local public and commercial services and establishments, preferring to shop in distant cities and to purchase education, police protection and recreation, etc. from the private sector for their own exclusive use. Recent studies have shown that the public involvement of large farmers tends not to be based in the local community, but involves work at the state, federal and international levels, lobbying, etc.

This dual class pattern produces rural "communities" in which public services tend to be non-locally based (i.e., county, state and federal) relief type agencies and the mainstreet type businesses cater heavily or exclusively to agriculture and the recreational and transitory needs of adult, working-class single men: i.e., welding shops, gas stations, bars, flop houses and brothels. [See Hawkes, et al., 1970.]

What we are trying to do in our ongoing research on small communities in the irrigated areas of California's central valley is to reconstruct the exact nature of the linkage between the structure of agriculture and social conditions in the small community. Our long-term project on 83 towns contains controls for farm size and residency of owners, cropping patterns, soil type, voting structure of the water district, etc. We hope that when the results of this longer study are available, we will be able to pinpoint with some accuracy the relative strength of the factors making up the relationship between the structure of agriculture and community social conditions. Preliminary findings on 36 communities suggest that negative social conditions are more associated with absentee ownership than with gross farm size, although both are positively and significantly correlated with community deterioration. In sum. management, ownership and labor are combined in a single unit on family farms. But as the locally owned family farm disappears, there emerges in its place a rural caste system in which owners, workers and management are three (often ethnically) distinct groups. If this evolution is permitted to proceed unchecked, the United States will soon have a high technology, heavily capitalized agricultural production system embedded in a rural society which is structurall similar to the Third World. Moreover, this arrangement will increasingly appear to be an intentional product of national policy.

The Lack of Articulation of Social Programs to Small Communities:

We first encountered the pattern of disarticulation of social services from their target social problems by accident in a 58 county study of the social organization of California agriculture. Using factor analysis, we were able to isolate three clearly different patterns of agriculture at the county level: The first was an agribusiness factor, a complex of large irrigated farms requiring upwards of $40,000 a year in operating expenses and deriving considerable income from government subsidies. The second most important factor in California has little or nothing to do with agriculture and can be called rural isolation and nonfarm poverty. The third is a small farm factor, family owned for the most part, and low income producing. (These three factors accounted for 56 percent, 33 percent, and 10 percent of the variance in the sample, respectively.) This description was devised for other research purposes, but out of curiosity, we decided to regress the factor scores against county-level Cooperative Extension program efforts: financial support and personnel levels in 4-H Youth Advisers, Family and Consumer Services, Home Advisers, Public Service, ENEP (expanded nutrition), etc. We found that at the time of our study (1978), there was no measurable relationship between small-scale family farming and Cooperative Extension social programs. (-.09 r) There was a weak but significant negative relationship between social programs and poverty (-.35 r), and a strong and positive correlation between the agribusiness factor and social programs. (.81 r)

We did not interpret these findings as indicating an ideological commitment on the part of Extension to a particular type of agriculture as some critics in California have suggested. On the basis of our conversations with members of the California Extension service at all levels, it seemed more likely to us that Extension is simply tempted to live in the past—its very successful past, with its very successful early partners--and not take the kinds of risks necessary to adapt its programs to new constituencies.

In another study of poverty in California undertaken by the Macrosocial Accounting Project for the State Office of Economic Opportunity, we found a similar problem of disarticulation of poverty programming and its target population. Since poverty program expenditures are supposed to be driven by the number of qualifying persons and families below the federal poverty standard, we tested the strength of the relationship between the program variables and poverty levels in each of the counties of the state of California. In the initial testing, without statistical controls, we found that poverty predicted 16 percent of the variation in poverty program expenditures. When we controlled for urbanization, however, this initial relationship was reduced to zero. In other words, we found that whatever small relationship exists in California between poverty and povety program activities is an accidental one, produced by a tendency for both poverty and poverty programs to concentrate in urban areas.

Along these same lines, in a study of the communities in the Sacramento region, my colleague Professor Edward Blakely found that the actual level of funding under New Federalism programs was not correlated with the community's technical qualifications for assistance, but was highly correlated with the number of workers in local government.

Some recent studies indicate that the pattern of disarticulation may be more pronounced in California than in other areas of the United States. For example, research on the health care delivery system in Massachusetts, and Don Voth's work on social programs in small communities in Illinois, show weak but positive correlations between program activities and their target populations.

Conclusion: There are many issues to be considered in the formulation of national-level policy as it affects agriculture and the small community. I have tried to bring out two here: (1) policy that leads to increasing concentration in agriculture can be dangerous to the health of the rural community, and (2) in California, at least, programs designed to alleviate some of the problems of rural people often do not reach their target populations. Beyond this, I think we may have set the stage for a pernicious interaction of these two problems which will accelerate the destruction of wide areas of American rural society over the next decades.

One interpretation of what is happening is that as it becomes increasingly difficult for American firms to operate in the Third World, we are marginalizing our own rural sector so that the kinds of practices and profits once possible in Latin America and Asia can now be pursued in our own back yard. I have no idea whether the conditions rural sociologists and others are beginning to find and measure in U.S. rural society are the products of accident or specific design. In my mind, it makes little difference because, whatever their origins, they are politically risky in that they cut against the grain of traditional American values. Specifically, they are neo-feudal in their implications and should be corrected as soon as possible.

There are other social and historical dimensions to the problem that I have not discussed. Foremost among these, in California, is the so-called rebirth of the rural community in which professionals, retirees, commuters and other recently urban peoples are moving into rural areas in unprecedented numbers. Let there be no illusion about where these "new rural" peoples are ending up. They are not found in the communities of the Westlands Water District or other areas dominated by agribusiness. They are found in the high valleys, foothill areas and rangelands. The process of reconstruction of the rural communities outside of the agribusiness areas is only another factor accelerating the destruction of the "undesireable" towns which must now compete with the "new people" for programs and resources. It should not come as a surprise that we are finding Mexican-American farmworker cooperatives to be no match for retired San Francisco stock brokers when it comes to applying for government grants, even for poverty funds. We have been trying to put some University resources (e.g., the information files of the Macrosocial Accounting Project) to work for the small communities embedded in the agribusiness areas. But this has been a mainly quixotic undertaking by an agricultural university which has only one rural and one Chicano sociologist on the faculty. So as we drive down the great central valley today, we can zig-zag between born-again towns--almost perfect reproductions of the ideal-typical American small town, recently refurbished by ex-urbanites--and broken down, working class Mexican-American agricultural ghettoes.

REFERENCES

Goldschmidt, Walter

1971 "Small Business and the Community: A Study in the Central Valley of California on the Effects of Scale of Farm Operations," pp. 4473-4607 in Role of Giant Corporations, Hearings before the Subcommittee on Monopoly of the Select Committee on Small Business. United States Senate Ninety-Second Congress, First and Second Sessions, November and December, 1971, and March 1972.

Hawkes, Glenn R., *et al.*

1970 Study of Single Men in the Agricultural Labor Force. Department of Applied Behavioral Sceinces, University of California at Davis, Xerox. [reference incomplete.]

MacCannell, Dean

1977 "What is Macrosocial Accounting?" Department of Applied Behavioral Sciences, University of California at Davis, Xerox.

1979 "Macrosocial Accounting as a Method for Community Research and Policy Formation," in Edward J. Blakely, ed., Community Development Research. New York: Behavioral Sciences Press, pp. 32-48.

1980 Report on Social Conditions in the Communities in and Near the Westlands Water District. Macrosocial Accounting Project, University of California at Davis, Xerox.

MacCannell, Dean, and K. Voss

1978 "Retesting Goldschmidt's Arvin and Dinuba Findings Using Macrosocial Accounting Techniques." Paper read at the National Meetings of the American Rural Sociological Association, San Francisco, August.

MacCannell, Dean, and J. White

1983 "The Effects of Large Scale Agriculture on Small Communities and the Prospects for Land Reform in California," in Charles Geisler, ed., Land Reform in America. New York: Allenheld.

Marr, Paul

1968 The Effects of Irrigation on Urban Development. Unpublished Ph.D. dissertation, Department of Geography, University of California at Berkeley.

Marshall, Ray

1974 *Rural Workers in Rural Labor Markets*. Salt Lake City: Olympus Press.

Office of Economic Opportunity

1971 *Annual Report*. United States Department of Agriculture.

Rodefeld, R.

1974 The Changing Organizational and Occupational Structure of Farming and the Implications for Farm Work Force Families and Communities. Unpublished Ph.D. dissertation, Department of Sociology, University of Wisconsin, Madison.

Rothman, Robert A., *et al.*

1977 "The Undulating Community: A Typology of Recurrent Migrations," Rural Sociology 42:1, 93-100.

Stafford, N. Jr.

1963 "The Functional Base of Small Towns," Economic Geography 39:2 (April), pp. 167-75.

Thomas, E. N.

1960 "Some Comments on the Functional Bases for Small Iowa Towns," Iowa Business Digest, pp. 10-16.

Background Paper No. 2

Report on the Structure of Agriculture and Impacts of New Technologies on Rural Communities in Arizona, California, Florida, and Texas

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Report on the Structure of Agriculture and Impacts of New Technologies on Rural Communities in Arizona, California, Florida and Texas

by

Dean MacCannell
Edward Dolber-Smith

Summary: This is a report on recent and current social conditions in the rural communities of the most agricultural areas of California, Arizona, Texas and Florida (CATF). The purpose of this report is to assess the probable impacts of changing agricultural technologies on these communities. The historical context and policy setting of this study are as important as its specific findings, and necessary for an understanding of the significance of the findings. United States agriculture is currently undergoing revolutionary change. Reports from other regions of the country indicate that the main features of this change are (1) increasing farm size and concentration of ownership, (2) increasing capital and off-farm labor requirements, and (3) increasing dependence on new technologies. The CATF study area occupies a unique position within the national framework in that the farming systems in these four states have already evolved into a large-scale, "industrial" type of agriculture. The number of farms in all size categories (except for the very largest category) showed an absolute decline. This reduction in the number of smaller (any category smaller than 2,000 acres) farms had the effect of increasing the concentration of land ownership resulting in nearly a 17 percent increase in average sales per farm at the same time that total agricultural sales increased by only 6.5% (see Table A-1a). These dollar figures are controlled for inflation. We think it is reasonable to assume

that many features of the relationship between farm structure and community conditions found in CATF today will spread to other rural areas in the United States as their agriculture evolves into the large-farm, industrial type.

The main unanticipated and unintended consequence of concentration and industrialization of American agriculture is a total change in the relationship between the agricultural economy and the rural community. In systems characterized by peasant farming and small-to-moderate scale family farming, the fate of the rural community is tied directly to the agricultural economy: improvements in production and sales of agricultural commodities translate into improvements in the social well-being of community members. Our data indicate clearly and unambiguously that in the areas of CATF where the main type of farm is larger than can be operated by a family unit, the positive linkage between agriculture and rural community conditions breaks down and in many cases becomes a negative linkage, i.e., improvements in the agricultural economy are associated with degradation of the rural community. In a tract-by-tract analysis of rural social conditions in the CATF, we found poverty ranging from five to 40 percentage points higher than other rural areas of the United States with up to 50 percent of the population living in poverty in some of the richest agribusiness regions. Less than three percent of the population of the United States lives in housing without plumbing, or in crowded conditions with more than 1.5 persons per room. These same figures range up to 20 percent of the housing stock in the richest agribusiness regions of CATF (See Table A-2).

These findings present a serious policy challenge, especially when viewed in the context of changing agricultural technologies. None of the technologies reviewed, including genetic engineering, nitrogen fixation, growth regulation, disease control, etc. are scale neutral in their projected adoption curves. Rather, they are projected to be adopted earliest and most extensively by farms in the largest sales class and later and less extensively, or not at all, by small and moderate scale operations. The projected adoption curve of new technologies will accelerate the trend toward ownership concentration and industrialization of agriculture. Our best estimate of future conditions in CATF agriculture, based on an assessment of the effects of new technologies, is further degradation of the rural communities.

Viewed within a public policy framework, this finding suggests the need (1) for farm programs specifically designed to slow and (in CATF) to reverse the trend toward concentration and industrialization; and (2) for rural community development programs to repair the severe damage which has already occurred in regions dominated by industrial agriculture. It is evident that a great deal of determination and innovation will be needed in designing and implementing new rural and farm policy given the "natural" tendency for technology to drive farm structure and rural society in socially negative directions.

I. The Role of Rural Community vis-a-vis Agriculture

I.0 Background on the CATF Study Area: Current agricultural patterns were not fully established in the CATF area until after World War II. Arizona was not even a state until 1912, and many of the new agricultural regions of all four states were not settled until this century. Historically and nationally, the original pattern of Spanish land grants and dependence on irrigation systems are the two main underlying causes of present day farming systems. Prior to this century, agricultural land holdings were enormous and the main products were range animals and non-irrigated grains. The first crude irrigation systems were built at the beginning of this century by land developers and speculators. The Imperial Valley of California went through several successive waves of irrigation, land sales based on the promise of cheap and plentiful water, irrigation system failure, farmer bankruptcy, land repurchase or re-possession by the original speculators, irrigation system overhaul, land resale, etc. This and similar abuses eventually brought federal intervention and public involvement in the construction and management of irrigation systems throughout CATF, some of which are heralded as the "Eighth Wonder of the World." The San Luis Unit of the California Central Valley Project, completed in 1969, was one such system. Current farm structure and rural community conditions in the most productive area of California (West Fresno County) have only a 15 year history.

Since World War II, the large agricultural operators of the CATF have been able to exploit their natural, historical, and political advantage by combining new agricultural technologies, modern irrigation techniques, government support programs, and an abundant supply of cheap foreign labor. At the present time, CATF occupies a pre-eminent position in the national agricultural economy and international trade. Half of the top 100 agricultural counties nation-wide are found in these four states. Agricultural products are the principle "industry" and export of California, Arizona, and Texas. In Florida, agriculture ranks behind tourism and manufacture but it still employs 77,000 workers and has an annual sales of $1.3 billion. [Carter, 1974:24] In Texas, the value added in agriculture is 1.3 times that of all manufacturing. [Texas: Agricultural Experiment Station, Texas Agriculture in the 80's, No Date] The economic position of agriculture within the CATF states is all the more remarkable when the high level of industrial development of these same states is taken into consideration.

The agricultural commodity mix of CATF is extremely diverse. With the exception of Florida citrus, there is no state-wide mono-culture or clear dominance of entire regions by a single crop or commodity (see Table A-3). Leading commodities of the four states are cotton, sorghum, beef, wheat, citrus, row crop vegetables, rice, sugar cane and beets, grapes, melons, avocados, strawberries, nuts, peanuts, and corn. Over nine million acres of cotton are grown in CATF amounting to 70 percent of the United States total and about 30 percent of the world trade in cotton. [USDA, Cotton and Wool Outlook, March 1981] Approximately one third of the rice production in the United States (eight percent of the world market) is grown in CATF. [USDA, Rice Outlook, October, 1984] One hundred percent of United States citrus production and 55 percent of all non-citrus fruits are grown in CATF. [USDA, Fruit Outlook, April, 1982] California alone grows over 25 percent of the table fruits and vegetables consumed in the United States. [Scheuring, 1982:2] Thirty percent of United States wool production is in CATF. Etc.

There are four dominant forms of agricultural operations in CATF: (1) large-scale family owned operations, (2) large scale corporate farms and partnerships, (3) highly sophisticated "part-time" operations owned by investors (usually urban-based professionals) which have high gross sales from small acreages, and (4) small scale unsophisticated part-time farming operations with low sales. There has never been a widespread tradition of moderate scale family operated farms in CATF. In the case of California, subsistence family farming never existed as a stable regional pattern. Nineteenth century wheat production in the Central Valley and Western foothills of the Sierra, sometimes called the "second California gold rush" began as serious, large-scale operations organized around commercial markets serving the population boom of the 1850s. In Florida, a tradition of small-scale agriculture grew up alongside of the larger holdings, but depression, the uncertain politics of swamp reclamation, and the emergence of a citrus monoculture have resulted in a trend toward increasing ownership concentration that started well before the current cost-price squeeze. [Carter, 1974:26-27].

I.1 Definition of a Rural Agriculture Community: Our study focuses on agricultural and social conditions in 98 counties in CATF which we designate as "high agricultural influence counties" according to the following critera. First, we selected the 43 counties in CATF from the top 100 agricultural sales counties nation-wide. These are the areas most likely to adopt new technologies and to be influenced by changes in the structure of agriculture. In addition to selecting from the top 100 counties nationally, we included an additional 83 counties which produce $2,000/yr. or more per capita in agriculture. These tended to be counties which were both highly agricultural and mainly rural in character. Their selection allows us to analyze the relationship of farm structure to rural community conditions in a relatively pure state, i.e., unaffected by the influence of nearby major cities. These definitions originally gave us a sample of 124 counties, but we ceded 26 Texas cattle and grain counties to Jan and Cornealia Flora's analysis of high plains agriculture. (Reported in "Emerging Agricultural Technologies, Farm Size, Public Policy, and Rural Communities: The Great Plains and the West.") This sample of 98 counties is the basis for the correlations and regression analysis of the relationship of farm structure to rural community conditions (Section III.4).

The descriptive Tables A-4a through A-4e, present the social data for the 98 sample counties compared to the other counties in the state. In addition to this broad comparison we have undertaken a fine-grained description of a few of the most agricultural tracts and counties presented in Tables A-2a through A-2h and discussed in Section I.4. These counties and census tracts were selected for close description if 20 percent or more of the labor force was classed as "farm labor" in 1970, and/or 15 percent or more was classed as workers in "farming, fisheries or forestry" in 1980. It should be remembered that the 1980 United States Census provides a much lower level of detail on questions of the structure of agriculture than the 1970 Census. In the 1980 Census, farm labor is split between the question "employed as a laborer" and the question "employed in farming, fisheries, and forestry." The actual number of farm laborers in 1980 is irretrievably lost.

I.2. Estimate of the Number of Rural Communities Affected by Farm Structure Changes: There are almost 5.5 million people living in the 98 "high agricultural influence" counties in our sample. We have not been able to determine the exact number of communities in these areas for the entire CATF area. In California, there are 83 towns with independent local governments located in the irrigated areas of the Central Valley. These towns range in population size from about 700 to 45,000. There are approximately 150 additional small (under 1,500 population) unincorporated places in the same irrigated agriculture areas (Source Macrosocial Accounting Project--Community Information Bank, University of California at Davis). About one out of seven California towns, located beyond the suburban fringes of the major cities are in the "high agricultural influence counties." An estimate of 300 incorporated places and an additional 700 smaller unincorporated but named communities seems reasonable for the 98 most agricultural counties of the entire four state study area: i.e., 1,000 communities averaging about 5,000 population.

Our field observations in California and analysis of the tract-level data for the other four states suggest that there are three main types of rural communities in the CATF study area:

1. Wealthy on-farm population/impoverished rural community. This pattern is found in the California Central Valley and parts of Texas.

2. Internally segregated communities. The classic "two sides of the tracks" phenomenon where rich and poor live in segregated neighborhoods of the same community. This pattern is found in and near Lubbock and Brownsville.

3. Externally segregated or "dual" communities. Entire rural communities dominated by a single social class or ethnicity. The result of this pattern is a region within which some of the towns are lower working class, farm worker and transient communities, while other towns,

nearby, exhibit the classic pattern of rural trade center, and are the community of choice for middle class in-migrants and non-agricultural industrial re-location.

I.3 Major Farm and Non-farm Characteristics Potentially Affecting Rural Communities:

(a) Irrigation: In the CATF study area, irrigation policy and practice is the single most important factor in maintaining both current levels of agricultural production, and the current disarticulation of community vs. agribusiness interests. Irrigation policy and practice includes the development of new water projects, maintenance of existing projects, state and federal water subsidies to agriculture, and governance and management practices of water districts. In perhaps no other area of American life are public and private interests so much at odds in some ways while being so intimately linked in others. The California Wright Act of 1887 enabled large land owners to take over private companies, issue bonds and levy taxes. There is a similar abrogation of the public domain in the organization of agricultural "Marketing Orders," and also in the controversial agricultural mechanization research and development programs in Western Land Grant universities. Current debate over water development in the CATF states is confused by this historical confounding of public and private domains in the agricultural sector.

While there is much confusion surrounding irrigation issues in the four states, several facts stand out. (1) CATF agriculture, as it is currently practiced, is fully dependent on modern irrigation systems built and maintained at public expense. (2) CATF agriculture is the primary consumer of all developed water supplies in the four states. Eighty-eight percent of the water in Florida is used for crop irrigation, the remaining 12 percent going for all other--industrial and rural and urban domestic--uses. [Carter, 1974:27] In California, 85 percent of the developed water supply is used in agriculture. [Scheuring, 1982:13] The same figures for Texas and Arizona are 76 and 90 percent respectively. [The New Columbia Encyclopedia, 1975]. (3) Competition with urban growth is creating increased public concern about the structure and practices, especially water use, of CATF agriculture and demands for its accountability.

It is important to maintain perspective on this last point. Competition for scarce water is not, in-and-of-itself a real crisis. A three percent water savings on the part of Texas agriculture would provide a water surplus sufficient to supply the entire city of Houston. New irrigation technologies can produce savings which would ease the current strain. The real threat to pursuing current practices in CATF agriculture is in the expanded debate over water reaching beyond rural farm communities and urban developers to environmental and consumer groups which are learning about the U.S. farm system for the first time. These groups are often shocked to learn that, for example, individual (large) farms in CATF use more water than many of the nation's smaller cities. There is growing concern in the non-agricultural communities of the West that too much of one of our most precious natural resources (water) is already controlled by too few members of society, and that the current structure of Western agriculture may pose a general threat to democratic institutions, especially at the local level.

(b) Immigration and Labor: To the extent that working conditions, wages and the differences in wealth which currently exist between the owners of industrial agricultural operations in CATF and agricultural labor is abhorrent to the American working class, CATF agriculture is dependent on legally and illegally imported, cheap foreign labor. Provisions of the current Immigration and Naturalization Act provide for temporary permits for otherwise inadmissible aliens to do seasonal agricultural work. (The exclusion for agriculture was enacted during World War II in order to free the rural labor force to join the Army, and it was never repealed.) Workers from Jamaica, the Bahamas, British West Indies, Philippines, Laos, Cambodia, Tailand, and India are found in CATF agriculture. But the great majority of "Greencard" workers are from Mexico and Central America. In addition to documented workers entering under provision of the Naturalization Act, there are substantial numbers of illegal aliens working in CATF agriculture. [Bertrand and Corty, 1962:97].

These foreign workers, legal and illegal, are finding ways of settling out of the migrant stream and are now an absolute majority of many of the rural communities in the heavily agricultural areas of CATF (See Tables A2A-H). Current demographic projections indicate that each of the CATF states will have a non-white majority by the year 2000. While there are other migrations contributing to this ethno-demographic transformation, especially the arrival of post-Vietnam Southeast Asian refugees and people fleeing from the conflicts in Central America, the change is being led by the immigrations of CATF agricultural labor.

Any legislation affecting immigration will have major consequences for the structure of agriculture in the CATF study area. It should be noted, however, that the actual consequences will not necessarily follow logically from the form of the legislation. The original Reclamation Law was never enforced in the agribusiness areas of the West, and it is quite unlikely that any change in the Immigration Act which would interrupt the supply of cheap foreign labor would be enforceable. The tradition of abuse of agricultural labor and immigration laws on the part of both owners and workers is so strong that legislative change is more likely to produce new forms of abuse than any new practices or relationships. The real threat here to CATF agriculture (as in irrigation policy change) is from public debate over immigration and the widened public understanding role of industrial agriculture in the changing ethnic composition of American society.

(c) Social and Cultural Conditions in the Rural Community: Local and national concern about the negative social conditions in the communities embedded in CATF agriculture could affect future policy. At the local level, there are important differences between regions in terms of built-in expectations regarding equality in the arrangements between ethnic groups. California is much richer than the other three states. California Chicanos aspire to leave agriculture and believe they have a right to a better future than agricultural work can provide. In Texas, there is more acceptance of the status quo on both sides of the color line, i.e., more fatalistic belief in the inevitability of racial inequality. In Florida, the co-presence of blacks in the agricultural labor force, along with middle and upper class Cuban expatriates in urban areas, and rural enclaves of poor whites, confuses the picture, and places great strain on social institutions: the schools, police, etc.

While politically weak and impoverished rural communities (the current norm in CATF) provide agribusiness with a dependent pool of unskilled and semi-skilled labor that is impervious to union organization, such communities are a potential liability under conditions where technological change leads to greater integration and interaction between agriculture and other types of industry. At the present time, CATF industrial agriculture is hyper-specialized, much like manufacturing in the 19th century. But if technological change makes it possible for agricultural machines and processes to be used for non-agricultural production, or if there is the need for a large-scale transformation of agricultural technology, current conditions in the local community could become a great liability. The lack of education, fear of authority, and the language barrier, which are such evident features of these communities, will make re-training, cross-training and the upgrade of tasks extremely difficult.

Similarly, any displacement of labor or reduction of the number of jobs resulting from new technologies could have potentially disruptive consequences. The data reported in the following section reveal a seeming paradox: namely, high levels of poverty in the same communities which have relatively high levels of employment, approaching 100 percent employed in some tracts. The capacity of CATF agribusiness to employ is well-known to urban-based welfare case workers in the cities who routinely refer their clients to jobs on nearby farms. There is a seasonal migration of over 15,000 welfare recipients from the city of Fresno to the west side of the San Joaquin Valley, for example. Any change in agricultural structure which substantially reduces its capacity to employ will drive up welfare roles and increase crime rates in rural areas, substantially increasing costs to local government, potentially producing a social environment that is unfriendly to agriculture itself.

(d) Environmental Degradation: Industrialized agriculture has, over the years, engaged in a series of practices which substantially alter soil, water and air quality. Large machines have compacted soils to the point where they cannot support plant life, and even larger machines are needed to rip open the surface again. Ground water has been "mined" dropping the water table to the point that aircraft engines have been adapted to drive well pumps. The mining of ground water leads to salnization of water supplies affecting not only agriculture but also residential areas. Chemicals used in the fields have built up to the point where they are highly toxic to plant, animal and human life. The State of California has recently ordered the Federal Bureau of Reclamation to clean up the agricultural sludge which has seeped into the Kesterson National Wildlife Refuge, or shut off the water to 42,000 acres of the Westlands Water District. Disregard for long range environmental consequences of some practices is producing local negative effects which, if they become general, could seriously disrupt CATF agriculture.

(e) Economic Issues: CATF industrial agriculture is highly dependent upon a world market for its product sales. The current strength of the American dollar has substantially reduced the competitive edge of many CATF agricultural products on the World Market and is creating a cost-price squeeze, less severe but similar to that being experienced by other United States farmers. Some of the largest corporations are considering leaving CATF agriculture but cannot find buyers and lenders to consummate the deals.

(f) System Failure: After a decade of spectacular growth and profits, around 1980, CATF agribusiness entered a period of declining productivity. (See Texas Agriculture in Transition.) This decline results from high costs of energy, inflation, high interest rates, speculation in land traded at inflated prices, continued high valuation of the United States dollar in foreign markets, competition with urban growth for water, environmental degradation including soil and water contamination by chemical residues, soil compaction, ground water mining, erosion, and acid rain. Finally, CATF agriculture is without allies in other sectors of United

States society because it is perceived as having sub-standard labor practices and abusing subsidies intended for small to moderate scale family farmers. Unless there is a broad base of policy and other initiatives (social and technological) to correct for a wide range of defects in CATF agriculture there is substantial risk of general system failure.

I.4. Interaction of Rural Community and Agriculture: Policy-makers in the United States are used to thinking in terms of an opposition of interest between large-scale industry and the urban community. But this same kind of understanding does not characterize thinking about the rural community and the agricultural economy. Indeed, in those times and places where the family farm prevailed as the main economic unit, there was little reason to think in terms of such an opposition: Before World War II, virtually any policy designed to strengthen agriculture would indirectly benefit workers as well as growers, and the rural community and rural non-farm populations as well. It was possible, then, to assume that programs providing economic benefits to agriculture would have generally positive social effects in rural areas. The main concern in earlier times, and in those places where the family farm was the dominant type, was appropriate levels of trade-off against urban programs. Much of the current stereotype of rural America is based on the historic, mid-Western, family farm experience. In a recent Saturday radio chat, President Reagan said, "Every American should have the opportunity to live in a small, rural community." He certainly could not have had in mind Rio Grande City, Texas or Three Rocks, California.

The conditions which favor unified agricultural and rural policies have never existed in the most productive agricultural areas of CATF. The presence of large-scale agriculture near the small communities in CATF make them the opposite of their ideal image. In the place of towns which could be described as providing their residents with a clean and healthy environment, social equality, local autonomy and democratic institutions, we have pesticide container dumps, wiring by extension cord strung from house to house, multi-house water supply from a single faucet, workers on minimum wage giving kick-backs to employers in order to keep jobs, children who have never been to school, and a range of related social pathologies. Few CATF agribusiness communities support a local middle class or the businesses and services demanded by that class.

The industrialization of agriculture and concentration of land and capital in the CATF study area has produced a new and clear division within the rural sector: namely, policies which benefit large-scale agricultural businesses do not automatically improve the life of agricultural laborers and rural non-farm peoples. In fact, there is mounting evidence that current policies and technologies designed to promote agriculture, insofar as they lead to the expansion of existing operations and greater concentration, in actual practice, also promote the deterioration of rural community life. This can be demonstrated by an analysis of the relationship of agribusiness to poverty in CATF.

Agribusiness and Poverty: The measure of federal poverty has been criticized both for being ungenerous (i.e., for underestimating actual poverty), and for being inflated (i.e., for failing to take into account income from food stamps, welfare payments, etc.). In California less than 15 percent of those persons below the poverty line are actually served by the social programs for which they qualify (food stamps, etc.), so it is likely that we are underestimating actual poverty(See Report on Poverty in California). For purposes of this analysis, however, poverty is used as a social indicator, not a measure of individual need. Even if it provides an underestimate of actual poverty, it is a good social indicator because it is intercorrelated with numerous other measures of social well-being: i.e., infant mortality, ethnic inequality, low wages, absence of quality social institutions, etc. Poverty levels in urban areas of CATF average around eight percent of the population. In rural areas, the average is about 12 percent. County-level poverty ranges up to 45 percent of the population in the 98 agribusiness counties in the study sample.

Tables A-5a through A-5e give scatter plot diagrams of the relationship of poverty to agribusiness in all the counties of the CATF states. The "California Pattern" noted in previous studies by the Macrosocial Accounting Project appears in Table A-5c. California exhibits a low dispersion, linear relationship in which increases in income from agriculture are associated with increasing levels of poverty. This relationship is remarkable for two reasons: (1) it is counter intuitive because increasing wealth (from agriculture) is associated with increasing poverty, and (2) it reveals poverty to be a rural and agricultural, not an urban, phenomenon as it is widely thought to be. One way to resolve this second point is to see CATF rural poverty as analogous to the urban poverty of Northeastern and

Northcentral states which derive most of their wealth from industry: except in family farm areas, we should expect to find relatively high levels of poverty associated with the main industry of an area whether this is manufacturing or agriculture.

While it is less apparent, the California pattern appears in the other CATF states. The Florida and Texas Tables A-5d and A-5e suggest that the relationship between poverty and agriculture has two forms. The first form is the California pattern in which substantial increases in income from agriculture are associated with small increases in poverty. The second pattern exhibits a steeper slope in which slight increases in agricultural income, up to a restricted limit, are associated with sharp increases in poverty.

A second way to look at the same relationship is via regression analysis. Tables A-6, 7, and 8, give the relationship of farm size to poverty in 1970, 1980 and to change in poverty 1970 to 1980. The first table shows a weak, negative relationship between farm size and poverty in 1970. In other words, there was still some evidence for a direct linkage between agricultural structure and community conditions in 1970: as farm size increased, poverty decreased. By 1980, this relationship had reversed. Table A-7 shows a weak but statistically significant positive relationship between farm size and poverty in 1980. By 1980, the farm system and rural community conditions had become disarticulated providing the first evidence suggesting that increasing concentration in agriculture leads to deteriorating social conditions. Table A-8 shows a strong and highly significant relationship between farm size and the rate of increase in poverty 1970-1980.

In the 98 study counties, over 30 percent of the increase in poverty is directly attributable to farm size differences with the greatest increases associated with the largest farm sizes. [Note: This regression and any of the following models which predict change over time contains a control for the dependent variable at time 1. As recommended by Kessler and Greenberg (1981)].

The maps in Appendix C (maps 1 through 8) give the geographical distribution of counties with poverty levels approximately one standard deviation above the state mean, and the geographical distribution of agricultural counties. These maps reveal that in CATF, poverty is predominantly a rural problem associated with agribusiness development. The fit between agribusiness and poverty is especially tight in California but it shows up in the other three states. The distinctive feature of this type of poverty is that it is found in intimate association with great wealth: i.e., only the richest agricultural counties have such high poverty levels. There is a second type of rural poverty found in the northern counties of Florida, which seems to fit the "Southern" pattern, and on the Indian reservations of Arizona. This non-agribusiness poverty affects almost everyone in its region--i.e., there are no super-rich businesses in close association with it.

A clearer picture of the effects of agribusiness and poverty at the community level appears in the tract descriptions in Tables A-2a through A-2h. These counties and tracts were selected on two criteria. (1) High rank position on agricultural sales, and (2) proportion of the population classed as agricultural labor in the 1970 Census. (Agricultural labor was not counted separately in 1980.) These counties and tracts are designated "rural agribusiness areas" to distinguish them from rural non-farm and other rural areas with only a moderate level of agricultural development. Conditions in these counties and tracts reflect the leading edge of current social change in the CATF and the United States. It should be noted in advance that there are certain problems with using the county as a unit for this kind of analysis. Many of these counties contain urbanized areas which are socially different from the rural parts of the county and contaminate and dilute the rural findings. Generally, the tract-level data more accurately reflect social conditions associated with advanced agribusiness development.

Findings: On every social indicator, the people who live in communities embedded in the richest agricultural areas in CATF are no better off, and in most instances are much worse off than their rural counterparts nationally. This is an especially problematical finding in light of the fact that sales per farm in these high poverty areas is about double that found in the low poverty rural areas.

Housing: In Arizona, three of the rural tracts had slightly better quality housing than the state average using plumbing as an indicator. The other nine tracts were worse off with lack of plumbing running as high as three times the state average (2.6 lacking plumbing for the entire state). None of the Texas tracts have housing comparable to the state average with lack of plumbing ranging over 25 percent of the housing stock in some areas. In Florida, where only county level data are available, two out of six agribusiness counties slightly bettered the state average, with percent lacking plumbing in the other counties ranging up to 18.6 percent. In California, overall, only 1.4 percent of the housing stock lacks plumbing. While the rural counties are relatively better off than their counterparts in the other CATF states, none equal the California average. In the agribusiness area of Imperial County, lack of plumbing is three times greater than the rest of the state; in West Fresno it is twice as great.

This same pattern appears in the data on crowding as measured by the proportion of the population living in houses with more than 1.5 persons per room. Only 0.7 percent of the population of the entire United States live in crowded conditions as measured. The proportions living in crowded conditions in the agribusiness tracts of CATF range from 5 to 32 percent in Arizona; 2 to 19 percent in Texas; one to 18 percent in Florida; and 7 to 18 percent in California. These same figures run about 30 percent higher for Spanish surname families in the rural agribusiness tracts of CATF. Up to 39 percent of the Spanish surname families live in crowded conditions in Arizona. The same figures are 21 percent in Texas, and 19 percent (black families living in crowded conditions) in Florida, and 23 percent in California.

Poverty: The proportion of the population living below the federal poverty standard in all areas of the United States is 9.6 percent. The same figure for all rural areas is about 14 percent. Poverty figures in CATF rural agribusiness tracts indicate much larger proportions of all segments of the population (families, unrelated individuals, Spanish surname families), live below poverty in these areas. In Arizona rural agribusiness tracts, family poverty affects about 20 percent of the population overall up to 35 percent of the families in one tract. Spanish surname family poverty runs five to 20 points higher in all the tracts. The poverty figures for unrelated individuals range up to 60 to 70 percent of the population.

In Texas agribusiness tracts, family poverty ranges from five to 40 percentage points higher than national averages, up to 47 percent of the population in poverty. The figures for Spanish surname families are consistently higher: varying from a few points up to 15 points higher than the total population figures. Four of the 10 Texas tracts have Spanish surname poverty exceeding 45 percent of the Hispanic population.

Summary of the Relationship of Agribusiness and the Small Community in CATF:

The CATF communities that are surrounded by farms that are larger than can be operated by a family unit have a bi-modal income distribution with a few wealthy elites, a majority of poor laborers, and virtually no middle class. The absence of a middle class at the community level has a serious negative effect on both the quality and quantity of social and commercial services (see analysis below), public education, local government, etc. Rothman *et al.* (1977) find that hired agricultural laborers are always located on the bottom of community status hierarchies, are always transient to some degree even if not technically migratory, and are never treated as full-fledged members of the rural community. On the other hand, the large-scale farm owner-operators tend to bypass local public and commercial services and establishments, preferring to shop in distant cities. These same large-scale farm owner-operators purchase education, police protection and recreation, etc. from the private sector for their own exclusive use so their needs and desires are not translated into *community* well-being. The recent public involvements of the largest farmers in CATF are not based in the local community, but in lobbying and selling at the state, federal, and international levels.

In sum, CATF rural communities in the most productive agricultural areas do not share in economic or social benefits from increased production and sales. Instead, the rural community stagnates or declines in the context of increasing agricultural productivity. Under these structural conditions, CATF agriculture is increasing its dependence on foreign labor. Continued importation of labor, operating within a different value system than the United States, is the only possible support for an agricultural economy which has become disarticulated from the local community. Increasingly, the rural communities in the CATF agribusiness areas are not "local" in the sense of participating in United States social and cultural traditions. They resemble more Honduran plantation communities, or Laotian communities, etc., than their rural counterparts in other areas of the United States. We have, in effect, imported Third-World social and economic relations in order to maintain the World Market position of CATF agriculture.

II. Likely Scenarios for Agricultural Structure by the Year 2000.

II.1. *Current Structure:* Unlike other areas of the United States, the assumptions of a current baseline condition with a diversified mix of farms by size and sales categories does not hold for CATF. There are many small-to-moderate sized family owned and operated farms in the CATF states. But these tend to be located outside the 98 study counties and they are marginal in other ways: mainly, they are disappearing and declining at a rapid rate. Table A-1b shows the pattern of change in the structure of CATF agriculture from 1970 to 1980 in sales and size categories and by ownership type. The number of farms decreased by 13 percent, the number of large farms (with 1,000 + acres) increased by 4.6 percent, the number of moderate sized farms (with 180 to 1,000 acres) decreased by 19.5 percent and the average size of a farm in the 98 county study area increased by 5.6 percent. All small-to-moderate categories of size and sales declined. The current structure of CATF agriculture is a dynamic but clear pattern of accelerating concentration.

The most distinctive feature of the current structure of farming operations in CATF is a pattern of part- and multiple-ownership in which the farmer owns and/or operates more than one farm, or parts of several farms, and combines agriculture with other forms of investment activity in real-estate, hotels, light industry, packaging and distribution of food, etc. The largest company in Yolo County, California, as measured by production and sales, makes it a point of pride that it owns no land, preferring to lease land in much the same way that United Fruit operates in Central America. One farmer in the study area recently purchased a major Las Vegas hotel-casino "to ease his cash flow problem." Even under conditions where this new industrial farmer lives on or near some of his agricultural operations, his unprecedented wealth and primarily urban and national orientation, combined with modern transportation and communication technologies, permit him to bypass the local community in all of his social, economic and cultural affairs, with the single exception of the need to obtain a steady supply of inexpensive unskilled and semi-skilled labor.

II.2. Dual Structure: In CATF, the prospects are slim for a so-called dual structure for agriculture in which many very small farmers account for 10 percent of production while a few large farmers account for 90 percent. If current (1970 to 1980) trends continue, there will only be large-scale industrial agribusiness operations, and no measurable small or moderate scale farming, in CATF by the year 2000 (See Tables A-1b). Only the very largest CATF farms in sales and acreage are increasing in numbers. There are already (1980) more farms in the higest sales categories than in the lowest in the 98 leading agricultural counties. Only nine percent of the farms in the high agricultural counties were in the lowest sales category (under $2.5K) in 1980. CATF farms participate in the dualization of United States agriculture on a national, not a regional, level. Concentration in CATF agriculture is marginalizing moderate scale farming in other regions of the United States. But within the major agricultural areas of CATF large scale farms already dominate all other forms of agriculture and urban and industrial growth as well. One of the most striking features of the countryside in the high agricultural areas of CATF is, outside of the poor worker communities, it appears de-populated, lacking in homes, services, roads, businesses, and, paradoxically, even in farms.

II.3. Increased Numbers of Moderate Size Farms at the Expense of Very Large Farms: Critics of concentration in United States agriculture argue for public policy initiatives to increase the numbers and market position of the moderate scale family owned and operated farm. Their reasons, often framed by their opposition in terms of "outdated," "romantic" values, are as follows:

(1) Wide distribution of responsibility for food production reduces the possibility of the emergence of a manipulative food cartel similar to the arrangements which now exist between oil producers.

(2) The social effects of large-scale agriculture in terms of poverty, malnutrition, disease, ignorance, unfit living standards, workplace dangers, and lack of institutions and socialization to American values are now known and will eventually require public solution at great public cost.

(3) Intergenerational family farmers are necessarily more concerned about the long-range viability of soils, water supplies, etc., than are businesses.

(4) We do not know the potential negative impact on United States democracy and institutions when all economically important areas of production, including food production, are controlled by a few companies. It may be historically unfair that agriculture must, in addition to its other problems, carry the burden of being the last major area of production in the United States not already concentrated in a few companies. It would take a real naif to assume that, should agriculture restructure along the lines of automobiles, aircraft, telecommunications, or steel, there would not be a major change in the basic democratic institutions in US society.

It is still possible, in most regions of the United States, if desired by the American people, to increase the numbers and market shares of moderate scale family farms by developing policy favoring such farms. Such policies, if enacted, will have little effect on the structure of CATF agriculture, however, and might even advance the concentration of CATF agriculture. The problem is that concentration is already so great in CATF that there is little available base of moderate scale farms which might be bolstered by special programs. Any government intervention targeting moderate scale farms in CATF will likely have the effect of transforming those few that remain into the large-scale industrial type.

III. Implications of Farm Structure Changes

III.1. Methods of Measuring Farm Structure: The following sections of this report discuss the results of analysis of the effects of farm structure and changing agricultural technology on community conditions. The analysis is based on regression models in which farm structure and agricultural technology measures are entered as independent or causal variables and measures of social conditions (median income, services per capita, etc.) are entered as dependent variables to be explained. It is remarkable that we are able to tap any relationship between agricultural structure and community conditions using the county as the unit of analysis with models as rigorously conceived as these. In these tests the assumption is that there are no other economic or demographic factors intervening between agricultural structure and social conditions in the 98 county sample.

We know this is a false assumption. The presence of many small and medium sized cities with relatively low rates of poverty, higher family incomes, and job opportunities in non-agricultural work certainly obscures the relationship between agriculture and rural community conditions in any county-level analysis. Nevertheless, we have demanded, in effect, that variations in agricultural structure predict all the variation in social conditions in the study sample, not just those conditions experienced by the people and communities embedded in the agricultural matrix. We have pursued this line of analysis because of a lack of readily available data at a more precisely delimited rural community level of analysis. In short, we are aware that the relationships we describe are diluted and would be stronger if we could obtain community-level data. But the results we have obtained serve to indicate the power of agribusiness to pull down social conditions for the entire county and region, not just for the nearby, small farm worker communities.

III.2. Farm Structure Patterns: The results of a factor analysis of agricultural variables (not shown), and ethnographic observations, suggest the presence of three main types of farming operations in the 98 high agricultural influence CATF counties.

(1) Large farms which are closely held, i.e., non-public but corporate ownership on large acreages. The owners of these farms do not work off the farms and the farm is located in an area dominated by similar, large operations. This is the classic "pioneer family" type of ranching which is also, nevertheless, a major agribusiness.

(2) Large farms which are held in partnerships, shares or corporations which trade stock in the open market. These farms depend upon full-time hired management and full-time and part-time labor, and have marginally better wage schedules and working conditions than the first type.

(3) Investment farms: specialty crops grown on small acreages near urban areas. These operations are owned by one or a few investors, usually urban-based professionals, who "work off-farm." More of these farms are fully owned than is the case for the other types. Unlike the pattern found in other areas of the country, these are not typically marginal operations supported by the off-farm work of the owner(s). In fact, a higher proportion of these farms fall into the highest sales cateogires ($100K plus) than the other two types.

III.3. Farm Structure and Farm Structure Change Variables: As has already been discussed, the dominant pattern in CATF agriculture is increasing concentration in sales and acreages. In other words, all three types of farms found in CATF are currently increasing in size, numbers and sales at the expense of family farms, "hobby farms," and urban expansion.

This study uses nine indicators of farm structure concentration as dependent variables.

(1) Percent of the farms in the county organized as corporations: In the CATF study area, five percent of the farms are corporately owned. This includes the most productive farms from all three types (See III.2.). Many family farms are incorporating without

changing their overall approach to farming. The incorporation variable appears to reflect modern, rational management and economic values. The wages and conditions of workers on incorporated farms are somewhat better than on unincorporated farms, for example.

(2) Size in acres: [See (3) below]

(3) Percent of the farms in the county with $40k plus in sales: This is a measure of concentration in the national, not regional, context. Regional concentration is reflected in a pattern of few farms with high sales dominating many farms with low sales. The pattern in CATF is for all the farms that stay in business to be increasing in size and sales. Thus, while these farms are not coming to dominate smaller farms in their own region, they are improving their position in the total picture of United States agriculture.

(4) Percent of farms with "full time" hired labor defined as workers who work 150 or more days per year on the farm: Full-time labor is closely associated with corporate ownership and is one of the few aspects of CATF agriculture that might lead in the direction of development of an indigenous "middle class" in CATF rural communities. This has not occurred as yet, but the full-time labor variables should be associated with positive social conditions, not negative, as would be hypothesized for most of the other agricultural structure variables.

(5) Cost per farm of hired labor: This is a measure of dependence on off-farm labor or the degree to which CATF agriculture has evolved away from family owned and operated farms.

(6) Cost per farm of contract labor: While some skilled labor is contracted in CATF, this measure mainly taps dependence on legal and illegal unskilled migratory labor.

(7) Per farm value of machinery: This is a measure of the degree of mechanization of production. It is confounded by differences in the characteristics of crops and their susceptability to machine processing. It can still be used as a basis for comparison between counties if not between farms.

(8) Per farm cost of fertilizer: This measures degree of capitalization of crop production and intensiveness of production practices.

(9) Per farm cost of other chemicals including pesticides and herbicides: This measures capitalization and intensiveness as well as willingness to accept potential long-range risks (new strains of pests, soil degradation, worker health) in exchange for higher immediate yields.

Table A-9 gives the correlations between the independent aagriculture structure) variables for 1970. The overall pattern of the matrix gives clear indication that, with the possible exception of farm size, the measures of agricultural concentration were strongly and positively intercorrelated by 1970. The matrix suggests the presence of a single, system-wide pattern of industrialization and concentration in agriculture. There is no evidence for a trade-off, for example, between machines and labor as would occur in areas where both traditional and modern types of agriculture are found. In CATF, as costs for machines increase, so do labor and other costs, gross sales, incorporation, etc.

Table A-10 gives autocorrelations between the same nine variables and their own rates of change, 1970 to 1980. Most of these relationships are weak but significant and negative. This indicates that it was the less concentrated and industrialized counties of CATF which underwent most rapid change between 1970 and 1980. What is occurring within CATF is the most productive areas are not increasing their advantage. Rather the less productive areas are catching up, creating a more uniform industrial agricultural system throughout CATF, improving its regional advantage over other areas of the United States. The only deviation from this overall pattern is in the areas of labor costs; those counties which had high labor costs n 1970 were also those which underwent the sharpest increases in labor costs between 1970 and 1980. This is the first of several indications that CATF agriculture is becoming more labor intensive and dependent, not less, even in the context of increasing mechanization.

III.4. Testing for the Goldschmidt Effect: In a 1944 study, which set the terms for the debate on the relationship of agriculture to social conditions in the United States, Walter Goldschmidt found a series of negative social effects associated with large-scale agriculture in the Central Valley of California. Goldschmidt's research was based on a matched pair comparison of a large farm community (Arvin) and a small farm community (Dinuba). He found higher median family income, lower poverty, better schools, more retail trade, stronger institutions including churches, more recreational opportunity, and more newspaper readership associated with the small farm complex surrounding Dinuba. Goldschmid'ts study has been heavily criticized, especially by representatives of agribusiness, for methodological inadequacy and because it violates economic common sense. For example, critics of Goldschmidt have argued that the differences he found between Arvin and Dinuba were only temporary, that the large farm community would eventually catch up with and surpass Dinuba on the diverse indicators of quality of community life. Other critics have argued that something other than the structure of agriculture was responsible for the better living conditions in Dinuba, or for the depressed condition of Arvin. The theoretical basis of all the criticisms of Goldschmidt's work has been that logic requires one to believe that as the dominant economic activity of a region modernizes and increases in volume, the entire region and all the communities, classes and groups within it will eventually receive benefits in the form of improved living standards. Goldschmidt and his supporters argue that when farming is practiced on a scale which exceeds a family's ability to provide the main source of labor and management, agriculture becomes disarticulated from the rural community and generates social inequality, poverty, and a range of associated pathologies.

Studies of the structure of agriculture undertaken by the Macro Social Accounting Project at the University of California at Davis suggest a modification to the original Goldschmidt hypothesis: the relationship of agricultural scale to community conditions is not linear. Specifically as agricultural scale increases from very small to moderate sized farms, the quality of community life improves. Then, as scale continues to increase beyond a size that can be worked and managed by a family, the quality of community life begins to deterioriate. In other words, the relationship of community conditions to agricultural resembles an inverted "U" curve. Preliminary evidence for the existence of this relationship has been found at the community level in a study of 83 California valley towns in which the sample was divided into two groups: one with an average farm size under 320 acres and the other with 320 acres. Increasing farm size in the under 380 acre communities was associated with improving community conditions, while increasing farm size in the over 320 acre communities was found to be associated with deteriorating community conditions. This kind of fine-grained analysis is only possible with community level data. At the county level, using regression, the existence of an inverted "U" relationship would only weaken correlations.

The present study provides an unusual opportunity to test the validity of the Goldschmidt position at the county level, without the usual confounding effects of small- to moderate-scale agriculture. Virtually all of the agriculture in the four state study area is organized according to Goldschmidt's large-farm type. Therefore, following Goldschmidt, one would hypothesize that measures of agricultural intensity would be positively associated with measures of social pathology.

III.5. The Static and Dynamic Relationship Between Agricultural Concentration and Community Conditions: We have tested the relationship between agricultural concentration and community conditions in two ways, (1) the static relationship between agriculture structure in 1980 and social conditions in 1980, and (2) the dynamic relationship of agriculture in 1970 and the rate of change in social conditions, 1970 to 1980. These tests appear as a series of regression models in Appendix D. All nine agricultural concentration variables were originally entered into each model as causal variables. Only those agricultural measures which *significantly* and *independently* predict variation in social conditions are retained in the final analysis. In other words, the absence of an agricultural variable from the model does not necessarily mean the absence of correlation with social conditions, only lack of independent predictive power.

Population: The measures of percent urban, percent rural farm and rural non-farm tend to be associated with agricultural concentration as would be expected. Average farm size is negatively correlated with percent urban and positive with percent rural, for example. But there are some agricultural concentration-population relationships which require closer scrutiny. Specifically, full-time workers on farms is positively correlated with urbanization. This finding suggests that farms organized around the concept of stable, long-term hired labor are found most frequently in regions with closer rural-urban ties and relationships. Similarly, corporate ownership is negatively associated with farm population as a percent of the total population but positively associated with non-farm population as a percent of rural. This suggests that incorporation is occurring in those areas which are less rural-farm in character with closer urban ties and higher proportion of non-farm people living in the countryside. This finding is consistent with the hypothesis that incorporation reflects participation in a wider value structure in terms of more standardized wages, working and living conditions for rural peoples and higher expectations for community quality. The association of incorporation with positive community conditions does not wash out the negative independent effects of farm size, mechanization, etc. (See the following sections.)

In the dynamic relationships of concentration to community conditions, high levels of corporate ownership and sales in 1970 predicts total population increases 1970-1980, while farm size and mechanization predicts stagnation or decreasing population. Farm size and use of machines also drives down rural population while hired labor increases farm population. With the possible exception of the hired labor/farm population relationship these findings are consistent with findings from earlier studies, including Goldschmidt's, to the effect that increasing farm size and industrialization is antithetical to organized rural community life.

Housing: One of the stated goals of the United States Reclamation Law is to promote quality home building in rural areas. In the dynamic analysis of change in the number of homes 1970-80, corporate farms predict increasing numbers of homes, while mechanization and farm size predict stagnation in home construction. Over 50 percent of the change in the amount of housing stock is accounted for by the agricultural structure model.

The percent of homes built before 1940 is a conventional measure of the quality of housing stock. Again, corporate agriculture is associated with proportional increases in newer homes, while mechanization and farm size in acres is associated with older homes and stagnation in home construction.

Income: Farm size is the strongest (negative) predictor of median family income in the static relationship: as farm size increases median income decreases. Full-time workers in agriculture is the only other variables to enter into an independent significant relationship with income. Full-time work is positively associated with median income, supporting the idea that this group may constitute an emergent middle class in some high agricultural influence counties.

The only 1970 agricultural concentration variable which predicts the rate of change in median family income 1970-1980 is proportion of the farms in the county with $40K plus annual sales. This model accounts for over 31 percent of the variation in change in median income and the relationship is negative: i.e., high sales in 1970 predicts low growth of income 1970-1980. In sum, the measures of agricultural scale, size in acres, and sales are inversely associated with median family income at the county level. This finding is counter-intuitive from the standpoint of common sense and economic reasoning, but it supports the Goldschmidt hypothesis.

Employment: Previous studies have shown the typical pattern of employment and unemployment in these high agricultural influence counties to be one of high employment and substandard wages (see MacCannell and White, 1984). The present study helps clarify this picture. Unemployment is negatively associated with both farm size and mechanization as previously determined: i.e., large, mechanized farms are big employers of unskilled workers at low wages. This is an especially problematical finding from a policy and planning standpoint because it suggests that job training is not an answer to the wage and employment problems of these areas. Rather, wages and working conditions of the jobs currently available must be targeted for change.

The proportion of farms with gross sales in the highest sales category ($100K plus) is correlated with unemployment. This is the first evidence we have found in these kinds of farming systems for a relationship between an aspect of concentration and unemployment. Overall, 31 percent of the variation in unemployment in these high agricultural influence areas is accounted for by the model.

The dynamic model did not predict change in unemployment at acceptable levels of significance.

Poverty: Ten percent of the variation in families below poverty and 14 percent of individuals below poverty is predicted by the agricultural concentration model in the 1980 static analysis. Average farm size is the strongest predictor for both families and individuals and the relationship is positive, i.e., supporting Goldschmidt's hypothesis: as average farm size increases, so does poverty. We think that agricultural concentration is a better predictor of individual (as opposed to family) poverty because of a relatively high proportion of unrelated individuals in the migrant labor population. Corporate ownership has a weak but significant negative relationship to poverty suggesting that marginally better wage structures are found in those areas where there are corporate farms.

Changes in family and individual poverty are associated with full-time employment: high levels of full-time work in 1970 predicts decreasing poverty 1970-80. Alongside of this expected finding, there is a strong _positive_ relationship between mechanization in 1970 and family poverty change 1970-80. This is further supporting evidence for the Goldschmidt hypothesis: the most mechanized counties have the most persistent poverty.

Local Government: The strength of local government as measured by taxes and per capita expenditures is not related to farm size and/or sales in the static analysis. Both taxation and levels of expenditure _are_ related to the proportion of farms with full-time hired help. This is further evidence for an emergent set of institutional arrangements supportive of a local middle class associated with stable and ongoing management-labor relations. In the dynamic analysis, high levels of corporate ownership in 1970 predicts increasing local government revenues 1970 to 1980, but high levels of mechanization in 1970 had a depressing effect on local government revenues. Farm size does have a positive relationship with an increase in property taxes. Full-time workers are associated with decreasing property tax levels.

Manufacture, Wholesale, and Retail Trade: Average farm size and high sales have a consistent depressing effect on measures of non-farm and off-farm economic activity. In the static analysis, farms with $100K plus sales is negatively associated with retail sales and retail establishments per capita. Farm size in acres is negatively associated with employment in services and manufacturing. All these relationships are significant and supportive of the Goldschmidt hypothesis. The overall picture that emerges is that as farm size and sales increase, other occupational opportunities and community amenities constrict. Corporate ownership and full-time labor continue to operate as buffers between the negative social impacts of size, sales and mechanization.

With but one exception, the agricultural structure variables did not predict change in wholesale and retail trade and other employment opportunities, 1970 to 1980. The concentration model did predict 45 percent of variation in the change in the numbers of retail trade establishments. And the use of chemicals on farms is associated with declining numbers of retail establishments, while corporate ownership is associated with increasing retail numbers.

Conclusion: With some qualification, the relationship of agricultural concentration to rural community conditions throughout the CATF study area supports Goldschmidt's original large industrial farm/small farm thesis. This is a rigorous test of the Goldschmidt hypothesis because (1) it measures social impacts of farm structure at the county level where any such impacts are weakened by other economic and socio-demographic patterns, (2) it tests for the relationships across four states, 98 counties and over five million people, and (3) it is restricted to rather small variations between counties pre-selected to represent only the highest levels of concentration, industrialization and intensiveness of agriculture found in the United States today. All these factors would tend to obscure the strength of the relationship between concentration in agriculture and rural community conditions. Nevertheless, we were able to measure many such relationships at statistically acceptable levels of significance. Repeated tests have shown that increasing farm size, mechanization and sales consistently and significantly predict declining social conditions not merely at the local agricultural community level, but in the the entire county.

The concentration variables which do not predict in a Goldschmidt direction are corporate ownership and full-time workers. The behavior of the full-time workers variable relative to community quality measures is understandable, but corporate ownership is more complex. Critics of large farms have often seized upon the term "corporate farm" as the best label for the pathologies which they want to oppose. It is now evident that there are several different forms of corporate farming ranging from subsidiaries of major food conglomerates to incorporation for tax purposes and, perhaps, as a way of delaying eventual economic failure. Incorporation in and of itself appears to represent a neutral form of modernization of the farm enterprise that may bring with it better and more stable relationships with banks, unions, non-union labor, consumers and environmental groups. Rural community problems are associated with farm size and measures of industrialization, not incorporation *per se*.

IV.0. *Impacts of Agricultural Technologies on Rural Communities:* It is not possible to project the specific impacts of new agricultural technologies by any *direct* measurement and modeling. The technologies in question are simply too new for us to obtain any data on their impact for even a few limited cases. However, using available measure of mechanization, farm size and chemical use, we were able to construct some general models of the relationship of technological change in agriculture to community conditions. While these models (which follow in the text) are crude with respect to the specific impact of new technologies, they represent the best estimates available for the probable direction of social change in response to future technologies.

We built the following model by selecting two available technology variables, machine cost per farm and chemical cost per farm, and size in acres and creating a typology of farming systems based on their characteristics in 1970 and patterns of change 1970 to 1980. For example:

MachHiHi = Those counties in which machine costs were above the mean in 1970 and the growth of machine costs 1970-80 was also above the mean.

MachHiLo = Those counties in which machine costs were above the mean in 1970 and the growth of machine costs 1970-80 was below the mean.

MachLoHi = Those counties in which machine costs were below the mean in 1970 and the growth in machine costs 1970-80 was above the mean.

Etc. for ChemHiHi, ChemHiLo, and ChemLoHi,

and

SizeHiHi, SizeHiLo, and SizeLoHi.

These size-technology types, in contrast to the LoLo cases, permit us to examine the social impacts of high and persistent, or recently growing use of agricultural technologies. The size in acres variable was entered into the model, because it was used as a criterion variable in the analysis of differential adoption rates of new agricultural technologies (see Office of Technology Assessment, March, 1985).

The resulting nine types of technological concentration and/or rapid acquisition of technology were entered as causal variables in a series of regression models using measures of social conditions as the dependent variables. Unlike the analysis discussed in the previous sections, all nine size-technology types were retained in the final regression equations, not just those which entered into a statistically significant relationship with community conditions. The results of this test are presented in two forms: (1) the original regressions shown in Appendix E, and (2) a series of graphs in which the shape of the significant relationships are portrayed in Figures 1 through 7.

Population: In general, agricultural technology variables are not strong predictors of changes in county population and population configurations (e.g., rural/urban ratios). This is understandable in light of the fact that virtually every variable used in this study, including the technology variables, has a population size control built in. There is not much variation left to explain. Increasing mechanization from a low base (MechLoHi) is found in those areas with low rural population. High and increasing farm size (SizeHiHi) is found in those areas with low rural population. High and increasing farm size (SizeHiHi) is associated with declining farm and rural nonfarm populations. These relationships appear as isolated "hits" in the regression models. There is one strong model: 26 percent of the variance in the change of farm population is accounted for by the size-technology model (see Appendix E, Figure 1). Increasing farm size 1970-80 is associated with decreasing farm population, mainly independent of conditions in 1970. On the other hand, high chemical use in 1970 in conjunction with continued high chemical use 1970-80 predicts increasing population. We are not confident that the direction of causality is from agricultural structure to social conditions in these relationships. It is possible that only those farms away from population centers can increase in size and/or that those near population centers practice a different kind of agriculture or grow a different crop mix involving the use of more chemicals.

Income and Employment: The technology-size model does not predict income differences between counties in the static analysis but it proves to be a good predictor of changes in median family income 1970-80. Thirty percent of the variance in changing family incomes is accounted for by five technology-size types, all in the Goldschmidt direction. High mechanication and chemicals in 1970 are the best predictors of declining median family incomes (see Appendix E-2, Figure 2).

Appendix E-3, Figure 3 gives the relationship of technology to unemployment. The only significant relationships here are with chemical use. High chemical use in 1970 and high 1970-80 growth in chemical use from a low base is associated with increasing unemployment.

FIGURE 1:

Change in Farm Population from 1970–80

Agricultural Counties

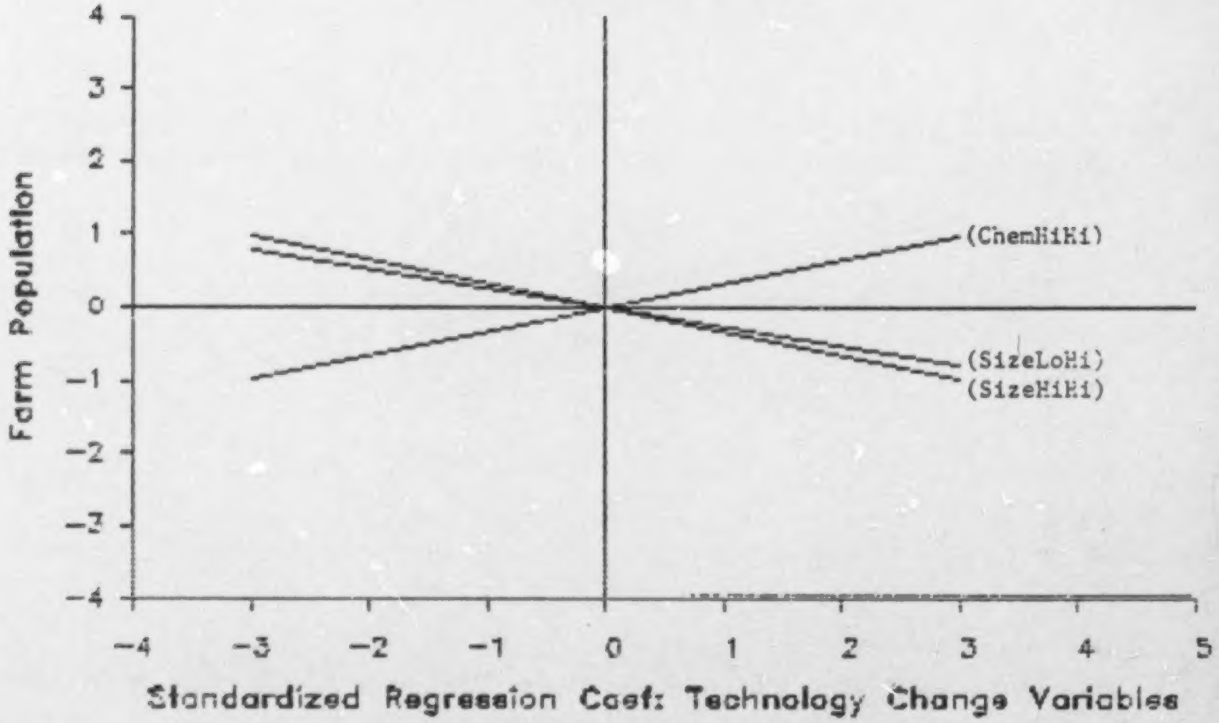

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FIGURE 2:

Change in Median Family Income from 1970–80

Agricultural Counties

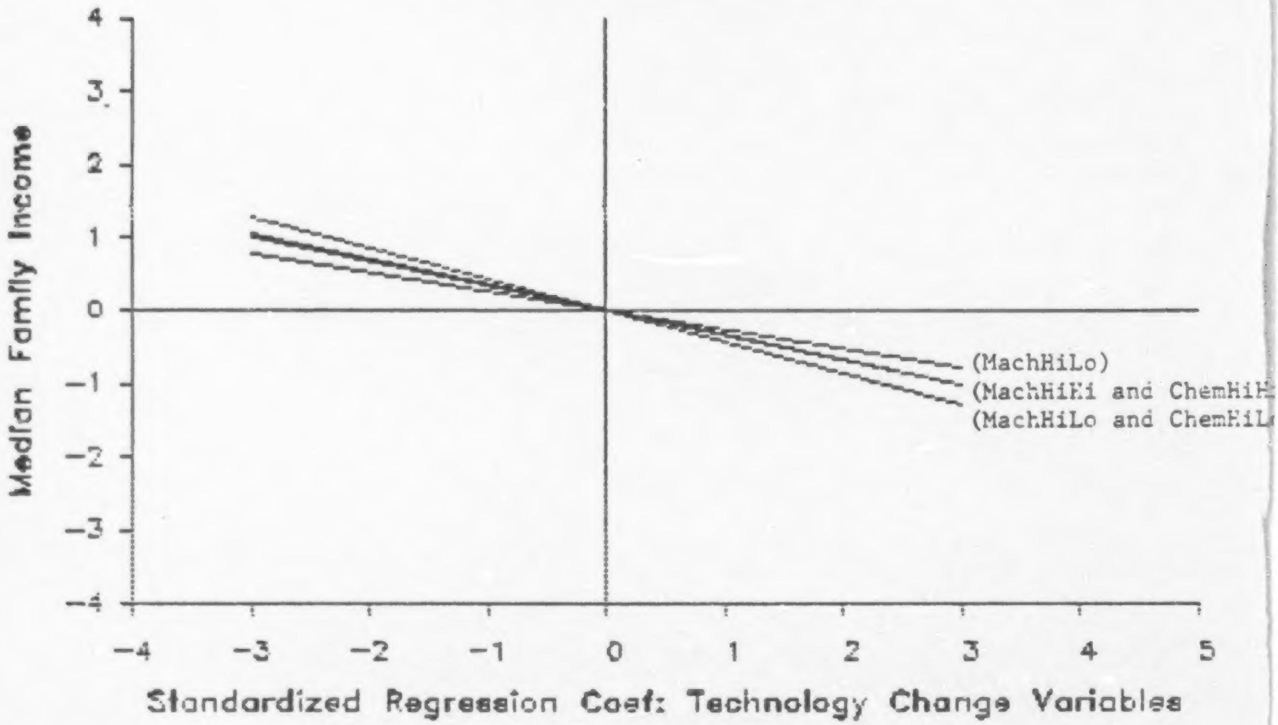

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FIGURE 3:

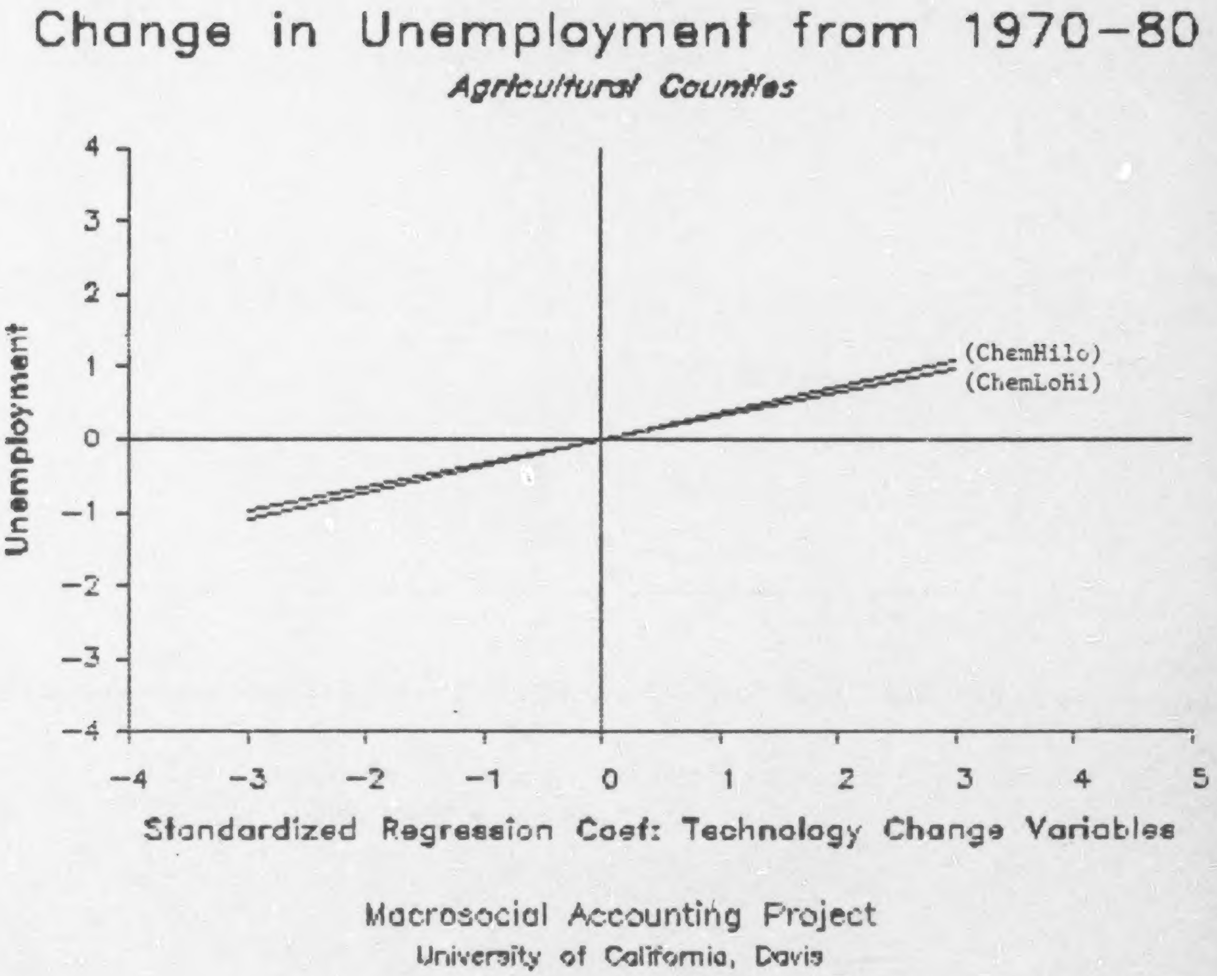
Change in Unemployment from 1970-80
Agricultural Counties
Unemployment
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4
5
(ChemHiLo)
(ChemLoHi)
Standardized Regression Coef: Technology Change Variables
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FIGURE 4:

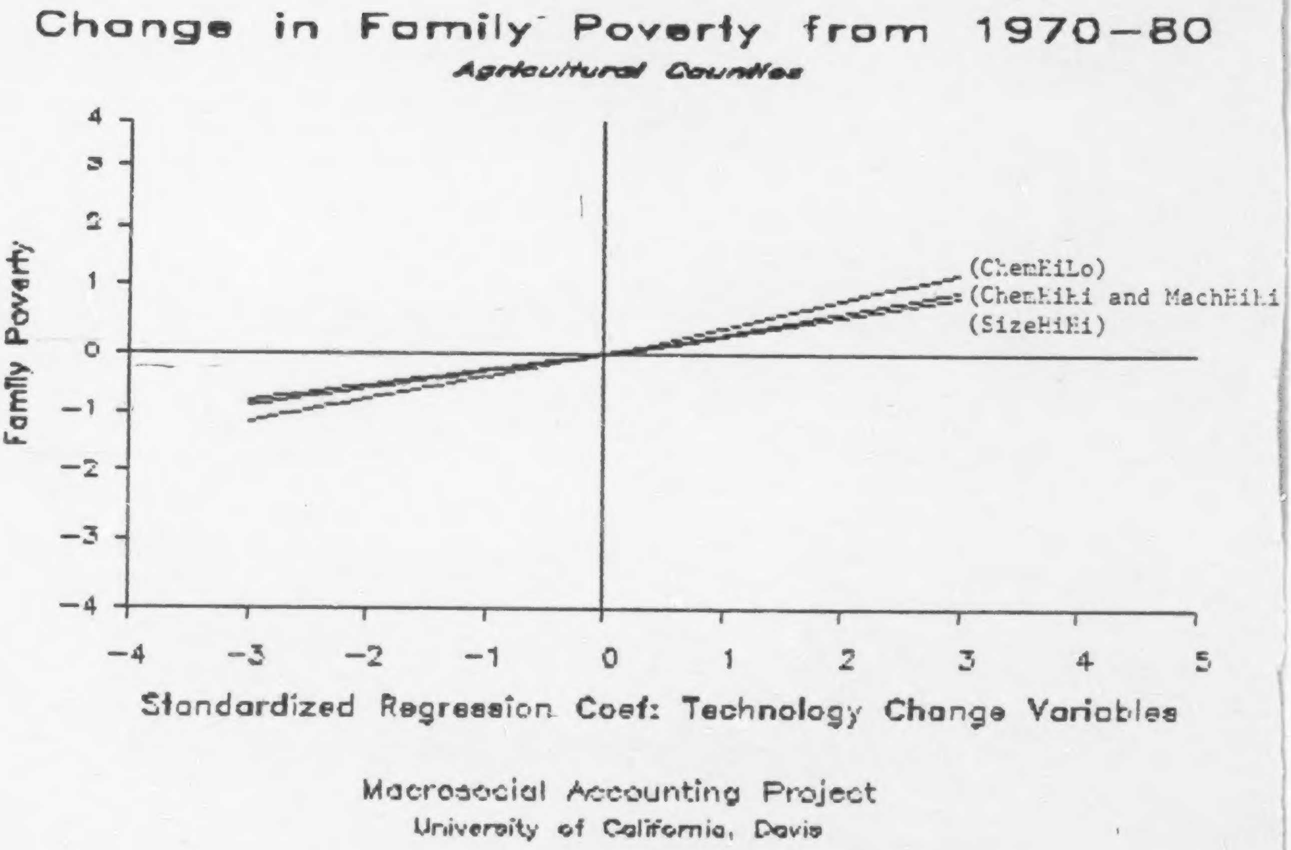
Change in Family Poverty from 1970–80
Agricultural Counties
Family Poverty
4
3
2
1
0
−1
−2
−3
−4
(ChemHiLo)
(ChemHiHi and MachHiHi
(SizeHiHi)
−4
−3
−2
−1
0
1
2
3
4
5
Standardized Regression Coef: Technology Change Variables
Macrosocial Accounting Project
University of California, Davis

FIGURE 5:

Change in Individual Poverty from 1970–80

Agricultural Counties

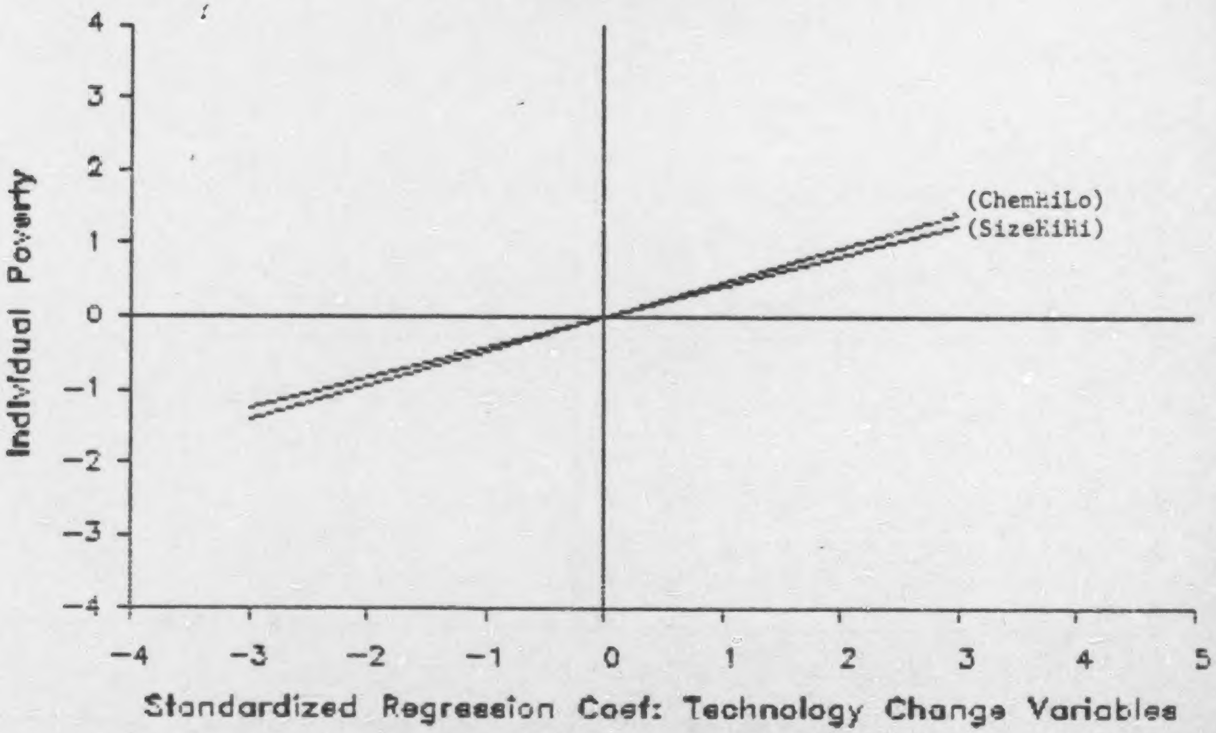

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FIGURE 6:

Change in Retail Establishments from 1970-80

Agricultural Counties

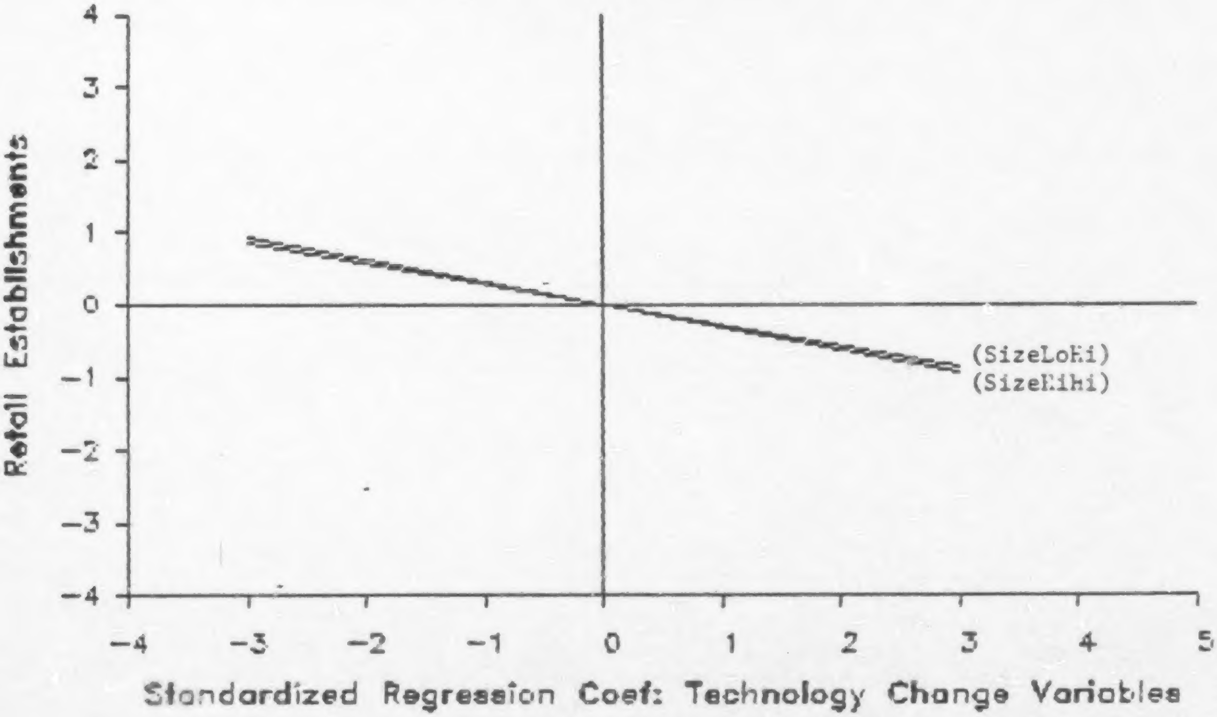

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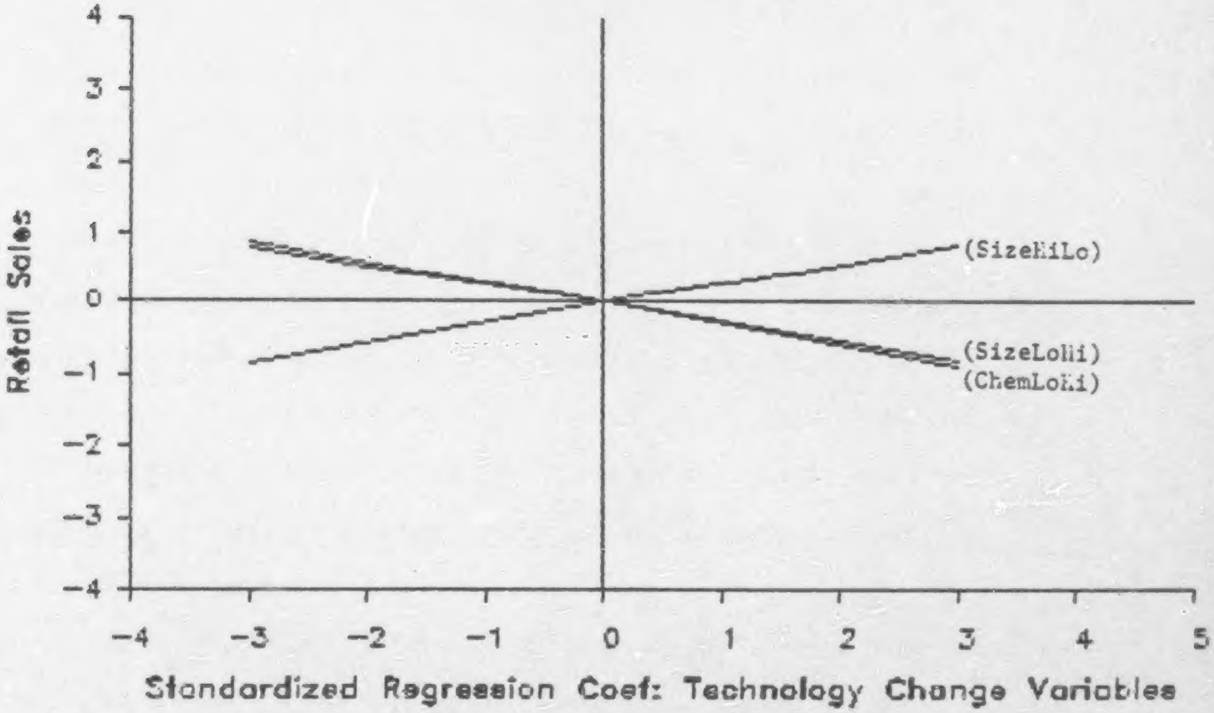
FIGURE 7:

Change in Retail Sales from 1970–80

Agricultural Counties



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Technology and Increasing Family Poverty: Throughout this study, family, as opposed to individual poverty, has proven to be difficult to predict using agriculture-structural variables. The working family serves as a buffer against poverty in an industrial agricultural context. This may be partly the result of cultural factors: i.e., longer periods of child-parent interdependence, and greater willingness of children among Hispanics to turn over earnings to their parents. However, the size-technology model (Appendix E-4, Figure 4 does predict 15 percent of the variation in the change in family poverty 1970-80. Three out of four of the significant relationships are in the HiHi pattern, all in the Goldschmidt direction. In other words, high technology and size in 1970 associated with continued high increases in technology and size, 1970-80, drive families into poverty. This is an important finding from the standpoint of public policy and technological change in that it suggests that stable family relations cannot ultimately withstand the pressures of scale increase and increasing technological change in CATF. These families will eventually succomb to poverty under intense technological development. Individual poverty is predicted by high and increasing size of farms and high chemical use in 1970 (see Appendix E-5, Figure 5).

Retail Trade: Appendix E-6, Figures 6 and 7 show the impact of technology and technological change on retail. Increasing farm size and chemical use, 1970-80, predicts declining numbers of retail establishments and per-capita sales. Those areas of large farms in 1970 which did not continue to grow in size 1970-80 increased their retail sales per-capita.

Discussion: The results of the forgoing special analysis of farm size and technology overwhelmingly support Goldschmidt's large industrial farm vs. small farm thesis. Every significant relationship is in the direction predicted by Goldschmidts' theory. The general conclusion to be drawn from these tests is that there is already advanced community deterioration in those CATF counties which have achieved the highest levels of agricultural-industrial development. This deterioration can be attributed directly to the structure of agriculture (i.e., high concentration and high dependence on technology) as it is practiced in the region. And finally, the current trend toward increasing farm size, concentration of ownership, and dependence on new technologies will accelerate the social degradation of these communities unless there is substantial programming aimed directly at correcting these pathologies.

The implications of these findings are especially problemmatical from a public policy standpoint when viewed in the context of current projections of agricultural technological change. Production scientists have argued persuasively that "American agriculture is poised on the threshold of another technological revolution." There is some concern already expressed that this technological revolution may have unforseen and undesired negative impacts on soil, air and water quality, wildlife and human health. On the basis of the evidence now before us, it is reasonable to add the rural community and rural family to this list.

IV.1. Labor Displacement: A great risk to the already overstressed and fragile rural communities of CATF is posed by labor displacement from new technologies. Traditionally and at the present time, work in industrial agriculture has been readily available. The government of Mexico estimates that its greatest source of dollars is the money sent home by Mexican nationals working in CATF agriculture. While the work is plentiful it is also the job of last resort: i.e., CATF industrial agricultural jobs are the lowest status and lowest paying in American society. Young Greencard workers in California repeatedly express their desire to leave the valley and find a "good job" washing cars or dishes in a city. When the agricultural jobs disappear there are no others for us to fall back upon, either individually or as a society concerned about the disorganizing effects of mass unemployment in an important sector of the economy: e.g., unpredictable migrations, organized crime, and the appearance of articulate anti-American sentiments within our own society.

Our research suggests that under current conditions, the risks of labor displacement are greater for chemical-based technologies than for machine-based technologies. This finding should be re-examined in light of the basic features of the 28 new technologies described in the larger OTA study--15 are chemical-based technologies. Eleven are machine-based, but most of these are actually computer-based. We have not been able to measure the effects of computers on farm structure and community conditions. In any event, most of the new technologies will be labor displacing, perhaps all of them will be. There are substantial risks that displacement will stress rural communities to the breaking point--i.e., generate problems which demand substantial public intervention.

IV.2 Scale Neutrality in Adoption of New Technologies: Our scale-technology models (Section IV.0) provide clear evidence that as farm size increases community conditions deteriorate. In reviewing the adoption curves of new technologies and packages of technology provided by OTA, none are projected to be scale neutral. While we realize that their figures may not be perfectly accurate, we think there is little reason to doubt the general conclusions about these new technologies reached by the production scientist teams: large farms will be the first to adopt and adoption will be the norm in the largest categories; small to moderate size farms will adopt slowly or not at all. There is only one possible social impact of this pattern. The larger farms will increase their market advantage and grow in size and numbers, and social conditions of agricultural labor and the small communities will continue to deteriorate.

Policy Recommendations

Following are a series of policy objectives which offer the possibility of a logical response to changing conditions of agriculture, agricultural technology, and rural communities. After each objective are one or more recommendations which would lead in the direction of realizing the objective. It is understood that not every recommendation is equally feasible from political, economic or other standpoints. We only want to suggest several alternative approaches in hopes of establishing a direction for policy and that some, at least, are feasible.

I. Small Community Improvement: During the decade of the 1970s, Americans moved into small communities in record numbers and the income and service disparity between rural and urban areas narrowed. While this trend is slowing, there is still substantial population pressure on small towns in rural America and new demands for sophisticated goods, services, and facilities. These pressures have had substantial negative impacts on traditional rural population groups (e.g., farm workers and small farmers) who cannot compete with new in-migrants for quality housing, services and jobs. Rural America is undergoing a change in which traditional groups of farm workers and farmers are being displaced into deteriorated homes, neighborhoods and facilities on the margins of the quality small towns. The process of marginalization of the rural working class will be accelerated by concentration and the technological changes discussed in this report. What is needed is a comprehensive small community improvement plan which benefits the new in-migrants and the traditional rural classes as well.

Recommendations:

1. Focus existing community development, Extension, and poverty programs on the specific needs of small communities and displaced and otherwise marginalized rural peoples.

2. In the case of rental properties, enforce building codes in rural areas. Owner-occupants of deteriorated rural housing stock should have access to grants and self-help packages to bring their dwellings up to code.

3. Good quality public housing should be provided migrant agricultural labor.

4. More rigorous and extensive monitoring of water and air quality, and enforcement of standards, is needed in rural communities. Enact specific

controls on environmental degradation associated with agribusiness development, i.e., burning of crop stubble, pesticide container dumps, irrigation water drainage, etc.

II. Increase Wages to Agricultural Workers: Real wages on very large farms throughout CATF are below minimum for many agricultural jobs. A top priority for agricultural and rural public policy should be to try to bring these wages into line with United States standards for both minimum wage and fair wages. Some of the jobs in CATF agriculture which are currently at or near minimum wage should be remunerated at much higher than the minimum. These jobs are seasonal and they require special skills and long apprenticeships, not unlike jobs in the construction trades.

Recommendations:

1. All barriers to unionization of agricultural labor should be removed.
2. Fringe benefit and retirement packages specifically tailored to migratory agricultural labor should be developed.
3. Where piece rates are used as the base for payment, the piece rate should be set high enough that even the slowest workers earn minimum wage equivalency.
4. The legality of "job costs" (e.g., transport to the fields, snacks, lodging fees charged workers by growers, etc.) should be investigated, and job costs which depress wages below minimum should be disallowed.
5. Professional standards and licensing procedures should be established for agricultural labor contractors ("coyotes") which clearly spell out their rights and obligations to workers and growers.

III. Improve Agribusiness Workplace Safety and Health Standards. There are numerous accident and health risks associated with work on very large farms. These include the possibility of injury from machines, pesticide and other chemical contact, exposure to sun, heat and dust. These risks are compounded by two factors: (1) warnings and instructions for the use of chemicals and equipment are often in a language that the worker does not know, and (2) there is a widespread belief that agricultural work is generally safer than industrial work, that risks are blown out of proportion, and no specific standards are needed.

Recommendations:

1. A program of strict enforcement of existing regulation governing the handling of dangerous substances specifically targeting very large farms.

2. New health standards, specific to agriculture, need to be developed: e.g., growers should be required to supply sanitary facilities, drinking water, a place to eat and take breaks, to workers in the fields.

3. Develop a national-level system of warning signs on dangerous equipment and substances. This system should be understandable by non-literate and non-English speaking peoples.

IV. Improve Schooling and Other Educational Opportunities to the Rural Poor and Rural Migrant Population. Over 50 percent of the non-white majority population in most industrial agricultural areas of the United States have four or fewer years of formal education and are illiterate in any language. All rural children should be required to attend school, and the schools should be required to develop programs which effectively teach basic skills, citizenship, and leadership.

1. Bilingual education and English as a Second Language should be upgraded and made effective for dealing with rural non-English speakers. English speakers in rural areas should learn one or more of the other languages in use in their region in their early school years.

2. Devise a system of transfer credits based on completion of education modules, not on time in school, so the skill levels of children who move a great deal can be monitored and upgraded.

3. Organize the curriculum in agribusiness areas around the labor needs of local crops, assuring that units in the schools begin and end corresponding to arrival and departure of migrants. (A computer model of regional labor requirements could be used to rationalize the curriculum.)

4. Support systematic study of the culture of the farm workers and new rural populations to provide a realistic base for curriculum materials, examples, and teacher approach that will be meaningful to these groups.

V. Increase the Proportional Representation of United States Citizens in Agribusiness Areas: Fifteen to fifty percent of the total population of most agribusiness areas is foreign born, and the great majority of these peoples are not United States citizens. Unlike their 19th century European counterparts, no specific outreach has been developed to encourage citizenship, and most of these new "Americans" do not contemplate citizenship.

1. Develop outreach programs into the agribusiness areas to encourage citizenship.

2. Organize adult education and literacy campaigns in a single package with training to be a United States citizen and resident. Emphasize the practical benefits and problems associated with residency, access to institutions, etc.

Bibliography

Bertrand, Alvin and Floyd Corty. Rural Land Tenure in the United States. Baton Rouge: Louisiana State University Press, 1962.

Carter, Luther J. The Florida Experience: Land and Water Policy in a Growth State. Baltimore and London: Johns Hopkins University Press, 1974.

Goldschmidt, Walter F. As You Sow. New Jersey: Allenheld, Osmun and Co., 1944 (1978).

Kessler, Ronald C. and David F. Greenberg. Linear Panel Analysis: Models of Quantitative Change. New York: Academic Press, 1981.

MacCannell, Dean and Jerry White. "The Social Costs of Large Scale Agriculture," pp. 35-54 in C. Geisler and F. Popper, eds. Land Reform American Style. New Jersey: Rowman and Allenheld, 1984.

Office of Technology Assessment. Technology, Public Policy, and the Changing Structure of American Agriculture, A Special Report for the 1985 Farm Bill (Washington D.C., U.S. Congress, Office of Technology Assessment, OTA-F-272, March 1985).

Rothman, Robert A., et al. "The Undulating Community: A Typology of Recurrent Migrations," Rural Sociology, 1977, 42:1, 93-100.

Scheuring, Ann F. California Agricultural History. Berkeley: University of California Press, 1982.

Scheuring, Ann F. Competition for California Water: Alternative Resolutions, eds., E. A. Engelbert with A. F. Scheuring. Berkeley: University of California Press, 1982

The Texas Agricultural Experiment Station. Texas Agriculture in the 80's: The Critical Decade. Texas Agricultural Experiment Station, N.D.

USDA. Cotton and Wool Outlook and Situation. Washington, DC: Economics and Statistics Service, March 1981.

USDA. Fruit Outlook and Situation. Washington, DC: Economic Research Service, April 1982.

USDA. Livestock and Meat Outlook and Situation. Washington, DC: Economics and Statistics Service, March 1981.

USDA. Proceedings -- Outlook '83. Washington, DC: USDA, 1983.

USDA. Rice: Outlook and Situation Report. Washington, DC: National Economics Division, Economic Research Service, USDA, October 1984.

USDA. Vegetable Outlook and Situation. Washington, DC: Economics and Statistics Service, March 1981.

CALIFORNIA

Population and Ethnicity

			CALIFORNIA	FRESNO	Firebaugh	Mendota	IMPERIAL			
	U S A	RURAL U S A	STATE TOTAL	County Total	Tract 84.02	Tract 83	County Total	Tract 0101	Tract 0102	Tract 0119
INDICATORS										
Population size x 1000	226,545.8	59,491.2	23,667.9	514.6	2.0	7.1	92.1	4.8	2.2	2.9
% Spanish Origin	6.5	2.5	19.2	29.3	46.3	83.1	56.0	52.0	60.0	90.0
QUALITY OF HOUSING										
% of without plumbing	2.2	5.9	1.4	1.0	.5	4.0	4.1	3.6	2.2	4.4
Occupied Housing Units: % living in house with > 1-5 persons/room	.7	.9	1.6	3.4	9.6	17.1	7.3	8.5	9.9	18.6
Spanish O-Housing Units: % living in house with > 1-5 persons/room	5.9	6.5	8.3	12.5	50.5	21.3	13.5	15.4	17.2	22.9
Spec O-O Housing Units: Median value of owner-occupied units x 1000	47.2	40.2	84.5	60.9	42.5	40.0	47.9	33.6	37.9	42.4
Spanish surname: Median value	44.7	30.1	69.2	46.9	14.4	39.1	43.7	33.0	34.4	42.4
POVERTY										
All families: At or below federal poverty level	9.6	10.6	8.7	11.4	13.6	20.1	12.7	12.9	14.1	21.8
At or below 125% poverty level	13.4	15.3	12.2	20.8	23.3	31.6	23.0	24.2	25.0	40.2
Spanish surname families: At or below federal poverty level	21.3	23.0	16.8	22.2	12.2	23.4	19.1	19.4	18.8	23.7
At or below 125% poverty level	28.3	31.9	23.7	35.2	27.3	35.1	30.1	29.2	34.7	42.3

CALIFORNIA, Population and Ethnicity

			CALIFORNIA	FRESNO	Firebaugh	Mendota	IMPERIAL			
	U S A	RURAL U S A	STATE TOTAL	County Total	Tract 84.02	Tract 83	County Total	Tract 0101	Tract 0102	Tract 0119
POVERTY, cont'd										
All:										
% of unrelated individuals for whom poverty status is determined	25.1	31.3	19.7	22.8	33.3	28.3	22.1	25.7	22.8	15.9
Spanish surname:										
% of unrelated individuals for whom poverty status is determined	35.9	45.3	30.8	36.8	42.4	32.3	30.5	34.2	33.3	24.1
Income										
All families:										
Mean income	23.1	20.7	25.5	22.3	21.8	14.4	20.9	16.1	17.9	20.2
Median income	19.9	18.0	21.5	18.4	16.0	12.3	16.7	13.1	15.2	13.6
Spanish surname families:										
Mean income	17.3	16.2	18.6	15.5	15.1	13.6	16.4	14.7	15.9	17.9
Median income	14.7	13.4	16.1	13.1	12.9	11.6	14.1	12.8	13.9	12.8
All households:										
Mean public assistance	2.5	2.2	3.0	3.2	3.0	2.8	3.0	2.5	3.1	3.0
Spanish surname families:										
Mean public assistance	3.0	2.3	3.4	3.6	3.1	3.1	3.4	3.0	3.9	3.3
All households:										
% income > $10,000	79.6	76.8	73.7	68.7	75.0	57.4	67.3	57.1	70.2	69.0
Spanish surname families:										
% income > $10,000	67.2	64.3	69.0	61.2	74.0	55.7	64.1	62.7	72.5	67.9
Labor Force										
All households:										
% of labor force employed	93.5	93.0	93.5	91.0	94.9	79.0	90.4	87.1	90.0	81.9
Spanish surname families:										
% of labor force employed	91.1	90.1	90.4	83.5	90.2	75.2	87.0	83.0	92.0	84.0
All families:										
% in farming/forestry/fishing	2.9	8.5	2.8	9.6	46.9	51.1	7.7	31.6	39.5	30.2
Spanish surname families:										
% in farming/forestry/fishing	4.7	20.3	7.5	22.7	61.0	58.0	20.7	42.2	47.0	28.5

TABLE A-2F

FLORIDA

Population and Ethnicity

	U S A	USA RURAL	FLORIDA STATE TOTAL	MADISON County Total	BROWARD County Total	DADE County Total	HARDEE County Total	MARION County Total	IMMOKALEE Total
INDICATORS									
Population size x 1000	226,545.8	59,491.2	9,746.3	14.9	1,018.2	1,625.8	19.4	122.5	11.0
% Black	6.5	2.5	14.0	74.5	12.7	22.4	9.9	20.1	24.8
QUALITY OF HOUSING									
% of without plumbing	2.7	5.9	1.2	11.9	.6	1.4	2.1	2.3	18.6
Occupied Housing Units: % living in house with > 1-5 persons/room	0.7	0.9	2.0	2.8	.9	3.3	2.4	1.0	7.7
Black Housing Units: % living in house with > 1-5 persons/room	5.9	6.5	11.0	7.8	9.3	8.3	3.3	4.4	7.0
All Families - Median Value Spec 0-0 Housing Units: occupied units x 1000	47.2	40.2	45.1	21.8	60.9	54.7	25.9	36.0	28.7
Black families: Median value	44.7	30.1	37.9	14.7	37.4	37.4	21.9	18.7	24.8
POVERTY									
All families: At or below federal poverty level	9.6	10.6	9.9	26.4	6.3	11.9	19.3	14.0	38.0
At or below 125% poverty level	13.4	15.3	14.2	35.6	9.0	16.2	26.1	20.4	44.1
Black families: At or below federal poverty level	21.3	23.0	31.1	--	27.0	26.4	50.8	38.9	70.3
At or below 125% poverty level	28.3	31.9	39.8	--	34.3	34.1	59.8	47.1	80.1
All: % of unrelated individuals for whom poverty status is determined	25.1	31.3	26.3	49.7	18.7	27.4	42.4	34.5	48.3
Black: % of unrelated poverty status for whom poverty status is determined	35.9	45.3	47.3	59.9	41.3	40.2	32.4	60.8	60.3

FLORIDA, Population and Ethnicity

	USA	RURAL USA	FLORIDA STATE TOTAL	MADISON County Total	BROWARD County Total	DADE County Total	HARDEE County Total	MARION County Total	IMMOKALEE Total
INCOME									
All families: Mean income	23.1	20.7	21.3	14.2	23.9	23.5	17.3	17.0	12.3
Median income	19.9	18.0	17.3	11.9	19.6	18.6	13.7	13.4	8.4
Black families: Mean income	17.3	16.2	13.7	--	14.9	15.8	11.9	11.4	5.5
Median income	14.7	13.4	10.8	--	12.1	12.7	10.3	8.7	4.8
All households: Mean public assistance	2.5	2.2	2.3	2.2	2.6	2.5	2.6	2.2	2.0
Black families: Mean public assistance	3.0	2.3	2.1	--	2.3	2.2	3.6	2.0	2.1
All households: % income > $10,000	79.6	76.8	75.9	58.7	81.4	76.4	65.4	66.1	31.9
Black families: % income > $10,000	67.2	64.3	53.3	--	58.8	60.3	52.4	43.3	28.9
LABOR FORCE									
All households: % of labor force employed	93.5	93.0	94.9	92.6	95.6	95.0	91.7	93.4	92.6
Black families: % of labor force employed	91.1	90.1	91.5	85.9	93.0	92.7	90.4	90.5	93.4
All families: % in farming/forestry/fishing	2.9	8.5	3.1	14.2	1.7	1.5	22.3	6.3	39.3
Black families: % in farming/forestry/fishing	4.7	20.3	6.7	14.9	5.4	2.9	24.9	10.1	44.6

TABLE A-2G

T E X A S

Population and Ethnicity

			TEXAS	CAMERON				HIDALGO					LAMB	LUBBOCK		
	USA	USA RURAL	STATE TOTAL	County Total	Tract 102.01	Tract 102.02	Tract 103	County Total	Tract 224	Tract 225	Tract 226	Tract 233	County Total	County Total	Tract 101	Tract 102
INDICATORS																
Population size x 1000	226,545.8	59,491.2	14,229.0	209.7	1.4	3.5	6.0	283.2	5.8	5.8	3.6	3.1	18.7	211.7	6.0	5.7
% Spanish Origin	6.5	2.5	21.4	77.1	76.1	62.9	71.3	81.3	93.1	96.6	97.2	96.8	38.5	19.6	26.7	21.1
QUALITY OF HOUSING																
% of year round housing units lacking complete plumbing for exclusive use	2.7	5.9	1.9	8.4	16.1	3.9	14.7	9.9	12.2	7.1	9.0	27.3	0.9	1.2	2.5	6.5
% of occupied housing units with 1.5 or more persons per room	0.7	0.9	1.6	11.1	11.3	10.3	10.4	12.6	17.7	17.5	21.1	19.1	2.3	2.3	2.1	3.3
% of Spanish Origin occupied units with 1.5 or more persons per room	5.9	6.5	7.7	15.7	16.6	17.1	16.1	17.1	19.9	17.9	21.3	20.2	12.5	10.8	10.0	13.5
Median value of owner-occupied units (X $1,000)	47.2	40.2	39.1	24.6	16.9	25.2	15.1	23.9	15.5	18.8	14.5	10.0	21.9	38.4	37.8	30.9
Median value of Spanish Origin owner-occupied units (X $1,000)	44.7	30.1	24.0	19.9	14.6	20.6	12.3	19.8	15.1	18.4	14.5	10.0	11.2	19.8	14.0	12.6
POVERTY																
All Families: % at or below federal poverty level	9.6	10.6	11.1	26.0	27.0	24.9	30.3	29.0	44.1	47.1	46.7	44.1	15.9	9.9	12.4	11.2
% at or below 125% of federal poverty level	13.4	15.3	15.5	34.5	36.9	45.4	52.1	38.0	57.3	70.3	54.0	59.6	23.1	19.8	20.2	24.5
Spanish Origin Families: % at or below federal poverty level	21.3	23.0	24.7	33.7	33.6	40.1	43.5	36.6	46.1	49.0	46.3	46.4	30.1	23.7	23.3	32.8
% at or below 125% of federal poverty level	28.3	31.9	33.3	44.0	43.4	61.4	59.7	47.3	59.6	71.8	53.5	61.6	47.1	36.8	42.9	60.0
Unrelated individuals: % who were at or below federal poverty level	25.1	31.3	27.2	41.3	46.7	60.1	47.2	43.8	59.7	55.4	71.4	78.4	35.0	29.5	28.3	26.9

T E X A S, Population and Ethnicity

			TEXAS	CAMERON				HIDALGO					LAMB	LUBBOCK		
	USA	USA RURAL	STATE TOTAL	County Total	Tract 102.01	Tract 102.02	Tract 103	County Total	Tract 224	Tract 225	Tract 226	Tract 233	County Total	County Total	Tract 101	Tract 102
% of Spanish Origin who were at or below federal poverty level	35.9	45.3	42.7	58.9	80.0	89.7	56.3	61.8	75.9	72.7	71.7	78.0	75.0	36.6	--	29.6
INCOME																
All Families: Mean annual income	23.1	20.7	23.2	16.5	16.0	20.5	12.8	15.9	11.4	10.1	10.7	11.9	18.7	22.9	21.3	18.8
Median annual income	19.9	18.0	19.6	12.9	13.2	12.6	10.4	12.1	9.3	8.2	7.8	9.2	14.5	18.7	17.4	16.6
Spanish Origin Families: Mean annual income	17.3	16.2	15.7	13.4	15.2	22.6	10.3	13.1	10.9	9.9	10.7	10.1	11.1	14.6	12.1	10.9
Median annual income	14.7	13.4	13.3	11.0	11.1	8.8	8.5	10.4	8.9	8.2	7.7	8.8	10.2	12.9	12.0	11.0
All Households: Mean annual public assistance (X $1,000)	2.5	2.2	1.8	1.8	1.3	1.5	1.6	1.7	1.4	1.8	1.4	1.6	1.9	2.0	2.3	1.9
Spanish Origin Households: Mean annual public assistance (X $1,000)	3.0	2.3	1.8	1.8	1.3	1.4	1.6	1.7	1.4	1.8	1.4	1.6	1.8	2.1	1.9	0.7
All Households: % of households with annual income of $10,000 or more	79.6	76.9	70.5	56.7	55.7	53.7	49.7	55.2	44.2	33.6	35.2	39.0	69.8	69.3	74.2	70.4
Spanish Origin Households: % of households with annual income of $10,000 or more	67.2	64.3	59.8	50.5	51.4	40.8	38.1	48.6	41.7	33.2	35.3	35.2	49.2	61.5	63.6	50.0
LABOR FORCE																
All Persons: % of persons 16 years and over in the labor force who were employed	93.5	93.0	96.0	92.2	86.7	93.9	86.2	91.5	91.7	85.3	89.5	83.9	97.4	96.9	96.9	97.1
Spanish Origin Persons: % of persons 16 years and over in the labor force who were employed	91.1	90.1	93.6	90.8	84.8	91.4	81.8	90.2	90.9	84.8	89.3	82.1	95.3	94.5	92.7	94.6
All Employed Persons, 16 years and over: % employed in farming/forestry/fishing	2.9	8.5	2.9	5.1	13.6	5.6	13.2	10.0	18.2	22.4	13.2	22.6	21.5	3.1	23.7	14.3
Spanish Origin Employed Persons, 16 years and over % employed in farming/forestry/fishing	4.7	20.3	4.2	5.5	16.7	8.4	9.8	11.4	19.0	23.1	13.4	22.6	25.9	4.2	27.0	26.7

TABLE A-2A

A R I Z O N A

Population and Ethnicity

	USA	RURAL	ARIZ STATE TOTAL	MARICOPA County Total	TRACT 608	TRACT 609	TRACT 822.02	YUMA County Total	TRACT 110	TRACT 112	TRACT 116	PINAL County Total	TRACT 20	TRACT 12	TRACT 19	TRACT 21
INDICATORS																
Population Size (X 1000)	226,545.8	59,491.2	2,718.2	1,509.2	3.7	4.3	3.2	90.5	1.4	3.0	1.9	90.9	4.7	2.4	2.3	1.8
% Spanish Origin	6.5	2.5	16.3	13.2	71.7	79.9	74.5	32.6	41.1	30.6	91.2	29.5	55.7	20.8	56.0	26.9
QUALITY OF HOUSING																
% of year round housing units lacking complete plumbing for exclusive use	2.7	5.9	2.6	0.8	3.9	10.3	2.2	1.5	5.2	4.1	2.7	3.2	3.8	3.8	8.5	1.9
% of occupied housing units: with 1.5 or more persons per room	0.7	0.9	2.5	1.9	13.6	17.8	12.1	6.3	9.9	6.1	32.7	4.8	6.6	5.2	12.4	5.2
% of Spanish Origin occupied housing units with 1.5 or more persons per room	5.9	6.5	6.0	10.5	18.8	22.5	16.7	14.6	27.2	14.8	38.8	8.3	11.3	13.1	20.5	14.3
Median value of owner-occupied units (X $1,000)	47.2	40.2	54.8	59.2	22.4	23.4	20.1	40.4	50.1	31.9	28.7	34.4	27.7	40.4	14.5	43.4
Median value of Spanish Origin owner-occupied units (X $1,000)	44.7	30.1	37.3	40.5	22.7	22.6	17.5	31.2	30.0	26.9	28.7	26.5	25.2	35.0	13.2	15.8
POVERTY																
All families: % at or below federal poverty level	9.6	10.6	9.5	7.5	33.5	25.6	35.4	12.3	18.9	18.2	22.4	14.3	26.5	11.6	39.9	23.0
% at or below 125% of federal poverty level	13.4	15.3	13.6	10.8	47.9	41.6	45.7	24.2	34.1	29.9	34.0	24.4	40.1	21.6	58.9	31.7
Spanish Origin Families: % at or below federal poverty level	21.3	23.0	18.2	19.0	39.6	24.9	44.3	21.9	30.4	26.4	27.6	18.3	32.6	27.0	45.0	39.5
% at or below 125% of federal poverty level	28.3	31.9	25.8	29.7	52.4	42.8	52.4	36.2	57.0	37.3	39.2	28.9	48.6	36.3	56.1	45.9
Unrelated Individuals: % who were at or below federal poverty level	25.1	31.3	25.5	22.9	44.6	70.8	58.5	26.2	57.4	35.2	37.1	34.3	50.1	47.0	62.7	24.2
% of Spanish Origin who were at or below federal poverty level	35.9	45.3	40.4	38.2	11.1	72.5	61.8	36.4	--	45.2	92.9	50.8	65.8	70.8	59.4	82.6

ARIZONA, Population and Ethnicity

	USA		ARIZ STATE TOTAL	MARICOPA County Total	Tract 608	Tract 609	Tract 822.02	YUMA County Total	Tract 110	Tract 112	Tract 116	PINAL County Total	Tract 20	Tract 12	Tract 19	Tract 20
INCOME																
All families:																
Mean annual income (X 1,000)	23.1	20.7	22.1	23.8	12.3	13.6	13.0	18.0	19.4	19.5	14.4	18.1	14.9	20.5	11.8	16.0
Median annual income (X 1000)	19.9	18.0	19.0	20.5	10.5	12.3	12.2	15.0	16.7	15.1	14.1	16.3	13.0	18.3	9.4	15.3
Spanish Origin Families: Mean annual income X 1,000	17.3	16.2	17.2	17.4	11.9	13.6	12.2	14.9	12.3	15.2	11.5	17.3	14.0	14.6	11.2	13.7
Median annual income X 1,000	14.7	13.4	15.5	15.6	10.00	12.1	10.7	12.7	10.9	14.1	12.9	16.6	11.8	12.4	9.6	13.3
All Households: Mean annual public assistance (X $1,000)	2.5	2.2	2.3	2.2	1.6	2.8	1.5	2.1	1.6	21.4	1.8	2.5	2.8	3.2	2.5	3.0
Spanish Origin Families: Mean annual public assistance (X $1,000)	3.0	2.3	2.2	2.2	2.0	2.5	1.2	2.1	3.7	1.2	1.8	2.4	3.0	3.7	2.8	1.7
All Households: % of households with annual income of $1,000 or more	79.6	76.8	71.2	74.7	50.9	55.5	51.8	64.6	65.1	65.5	55.9	65.0	57.8	65.0	38.0	68.2
Spanish Origin Households: % of households with annual income of $10,000 or more	67.2	64.3	65.9	67.0	51.9	58.2	47.8	62.6	56.9	72.6	58.0	68.8	56.5	54.0	42.6	55.1
LABOR FORCE																
All Persons: % of persons 16 years and over in the labor force who were employed	93.5	93.0	93.8	94.5	90.1	90.8	92.0	92.0	86.4	96.6	83.3	92.3	89.9	93.4	82.4	92.4
Spanish Origin Persons: % of persons 16 years and over in the labor force who were employed	91.1	90.1	91.2	91.6	90.9	89.8	91.4	87.3	75.5	94.2	82.6	92.3	87.6	89.4	88.3	86.0
All Employed Persons, 16 years and over: % employed in farming/forestry/fishing	2.9	8.5	2.7	2.2	24.4	20.6	23.5	12.6	30.1	32.2	57.7	8.3	15.8	24.6	28.4	27.2
Spanish Origin Employed Persons, 16 years and over % employed in farming/forestry/fishing	4.7	20.3	7.4	7.8	30.2	23.8	31.0	28.6	6[illegible].8	51.8	59.6	13.3	25.3	63.2	38.6	46.0

TABLE A-3

INFLUENCE OF THE STRUCTURE OF AGRICULTURE
Summation of Counties for all States

Number of Counties in this Analysis...
Total Counties: 97

Agricultural Impact is Moderate: 12 Counties
(But Market Value is High)

Agricultural Impact is High: 85 Counties
(Regardless of Market Value)

Population of these Counties...
Total: 5233112.
Mean: 53950.
Standard Deviation: 108959.

Market Value of Ag Products in these Counties ($1k)...
Total: 15456647.
Mean: 159347.
Standard Deviation: 281798.

POPULATION IMPACTED: BY FARM PRODUCT
Summation of Counties for all States

Ag Product	# Counties w/ good data	All-Crops Value ($1k)	Crop-Specific Value ($1k)	Crop as % of All-Crops	Population Affected	Crop's Impact
Crops, in General	76	14602383.	6536071.	44.760	5015723.	2245053.
Grains	85	14149274.	942135.	6.659	4145047.	276000.
Cotton	84	13915563.	1384223.	9.947	4482395.	445877.
Tobacco	97	15456647.	2667.	0.017	5233112.	903.
Field Seeds	73	13870739.	283044.	2.041	4501009.	91847.
Vegetables	70	14395553.	1383683.	9.612	4905146.	471477.
Fruits	60	12610946.	2082378.	16.512	4703914.	776732.
Nursery & Grnhse	58	10820244.	231632.	2.141	4041356.	86514.
Other Crops	77	13238286.	462952.	3.497	4330396.	151437.
Livestock & Poultry	80	14975224.	4683069.	31.272	5118083.	1600533.
Poultry	40	10467628.	537362.	5.134	3702528.	190072.
Dairy Products	63	12482426.	801126.	6.418	4651112.	298510.
Cattle	97	15456647.	3405383.	22.032	5233112.	1152951.
Hogs	78	14638513.	51583.	0.352	5051868.	17802.
Sheep	63	13154429.	62105.	0.472	4133695.	19516.
Other Livestock	87	14720545.	39217.	0.266	4956740.	13205.

TABLE A-4A

		Ragional Summaries		State-wide Summaries			
		The Nation	AZ CA FL TX	Arizona	California	Florida	Texas*
County Pop.	Mean Value	226545305.00	128146.65	194158.21	408067.28	145467.52	56020.44
	Stand Dev.	.	462999.67	399888.45	1034336.09	267517.07	201788.18
	Min. Value	226545805.00	91.00	11406.00	1097.00	4035.00	91.00
	Max. Value	226545805.00	7477503.00	1509052.00	7477503.00	1625781.00	2409547.00
Rural Pop.	Mean Value	59494813.00	17633.32	31391.93	35522.34	22894.61	11402.26
	Stand Dev.	.	20072.70	19611.42	30805.88	18680.11	13020.33
	Min. Value	59494813.00	0.00	4425.00	0.00	3543.00	91.00
	Max. Value	59494813.00	125898.00	71660.00	125898.00	92146.00	99320.00
Percent Pop. Rural	Mean Value	26.26	52.07	39.85	41.24	52.55	55.09
	Stand Dev.	.	30.66	19.07	31.83	32.64	29.79
	Min. Value	26.26	0.00	4.75	0.00	0.49	0.60
	Max. Value	26.26	100.00	76.19	100.00	100.00	100.00
Farm Pop.	Mean Value	5617903.00	1317.56	983.57	3042.41	875.81	1058.65
	Stand Dev.	.	1988.97	988.92	4452.67	805.11	797.57
	Min. Value	5617903.00	0.00	161.00	0.00	0.00	13.00
	Max. Value	5617903.00	25082.00	3778.00	25082.00	4013.00	4086.00
Percent Pop. Farm	Mean Value	2.48	6.09	1.17	2.64	2.81	8.01
	Stand Dev.	.	6.61	0.80	3.07	3.67	7.17
	Min. Value	2.46	0.00	0.22	0.00	0.00	0.03
	Max. Value	2.48	45.75	2.54	14.30	20.42	45.75

* Values do not include those counties in the C. Flores analysis.

TABLE A-4A

TABLE A-4B

		States in the Analysis							
		Arizona		California		Florida		Texas*	
		Ag Influence		Ag Influence		Ag Influence		Ag Influence	
		- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-
County Pop.	Mean Value	211395.25	90736.00	517614.55	164628.89	149235.02	121188.11	84662.50	16066.22
	Stand Dev.	432107.13	257.39	1230607.96	148190.74	277854.88	198933.53	255114.23	36407.63
	Min. Value	11406.00	90554.00	1097.00	8610.00	4260.00	4035.00	3315.00	543.00
	Max. Value	1509052.00	90918.00	7477503.00	514621.00	1625781.00	576863.00	2409547.00	283229.00
Rural Pop.	Mean Value	31220.17	32422.50	32802.68	41566.06	21903.74	29280.22	15606.54	5691.48
	Stand Dev.	21231.15	6248.70	31196.80	29885.50	16324.97	30446.25	14207.32	8663.76
	Min. Value	4425.00	28004.00	0.00	5585.00	3543.00	4035.00	543.00	543.00
	Max. Value	71660.00	36841.00	125898.00	111520.00	86487.00	92146.00	99320.00	70748.00
Percent Pop. Rural	Mean Value	40.53	35.72	43.77	35.59	50.59	65.16	48.12	57.01
	Stand Dev.	20.54	6.79	36.54	16.92	32.69	31.19	26.28	30.69
	Min. Value	4.75	30.93	0.00	17.67	0.49	7.19	0.60	10.52
	Max. Value	76.19	40.52	100.00	68.14	100.00	100.00	100.00	100.00
Farm Pop.	Mean Value	859.08	1730.50	1462.45	6553.44	829.67	1173.11	1169.54	1038.33
	Stand Dev.	1000.59	631.45	1622.18	6443.08	794.37	858.36	818.24	785.85
	Min. Value	161.00	1284.00	0.00	1031.00	0.00	205.00	21.00	81.00
	Max. Value	3778.00	2177.00	6565.00	25082.00	4013.00	2847.00	4086.00	3800.00
Percent Pop. Farm	Mean Value	1.05	1.91	1.28	5.66	2.43	5.27	4.71	13.00
	Stand Dev.	0.77	0.69	1.23	3.75	2.97	6.36	3.93	8.72
	Min. Value	0.22	1.42	0.00	1.23	0.00	0.13	0.03	0.51
	Max. Value	2.54	2.39	5.75	14.30	12.64	20.42	18.33	45.75

* Values do not include those counties in the C. Flores analysis.

TABLE A-4B

TABLE A-4C

		Regional Summaries		State-wide Summaries			
		The Nation	AZ CA FL TX	Arizona	California	Florida	Texas*
Median Income	Mean Value	19917.00	16649.96	16631.36	19238.43	15239.54	16431.96
	Stand Dev.	-	3334.53	2673.45	3300.14	2570.26	3251.64
	Min. Value	19917.00	8627.00	11872.00	13522.00	10920.00	8627.00
	Max. Value	19917.00	29721.00	22661.00	29721.00	20873.00	27179.00
Percent Family Poverty	Mean Value	9.58	13.31	13.99	9.12	13.76	14.12
	Stand Dev.	.	6.00	7.52	2.50	5.27	6.28
	Min. Value	9.58	0.00	6.85	4.47	6.06	0.00
	Max. Value	9.58	45.00	35.30	18.15	26.41	45.00
Percent Unrelated-Individual Poverty	Mean Value	12.08	14.16	12.32	9.35	14.90	15.10
	Stand Dev.	.	6.10	3.44	2.31	5.28	6.37
	Min. Value	12.08	3.40	7.50	4.50	6.70	3.40
	Max. Value	12.08	45.00	15.20	14.40	26.40	45.00
Percent Unemployed	Mean Value	6.52	5.13	7.58	9.29	5.81	3.86
	Stand Dev.	-	2.94	2.12	3.30	1.36	2.06
	Min. Value	6.52	0.38	5.23	3.52	3.04	0.38
	Max. Value	6.52	17.58	12.56	17.58	8.55	13.46
Pre-1940	Mean Value	25.85	18.24	11.76	16.14	10.11	21.23
	Stand Dev.	-	10.52	7.51	9.35	5.73	10.51
	Min. Value	25.85	1.22	3.32	3.68	1.22	3.64
	Max. Value	25.85	57.69	28.06	57.69	28.64	53.60

* Values do not include those counties in the C. Flores analysis.

TABLE A-4C

TABLE A-4D

		States in the Analysis							
		Arizona		California		Florida		Texas*	
		Ag Influence		Ag Influence		Ag Influence		Ag Influence	
		- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-
Median Income	Mean Value	16794.25	15654.00	19886.78	17797.67	15332.24	14642.11	17100.78	15350.86
	Stand Dev.	2858.60	893.78	3692.86	1429.82	2583.18	2548.27	3308.51	2886.41
	Min. Value	11872.00	15022.00	13522.00	15617.00	10920.00	11427.00	8627.00	9728.00
	Max. Value	22661.00	16286.00	29721.00	20495.00	20873.00	19817.00	27179.00	24229.00
Percent Family Poverty	Mean Value	14.10	13.31	8.44	10.63	13.70	14.13	13.01	16.46
	Stand Dev.	8.16	1.40	2.56	1.55	5.43	4.29	5.57	6.80
	Min. Value	6.85	12.32	4.47	7.96	6.06	6.75	4.64	3.40
	Max. Value	35.30	14.30	18.15	13.15	26.41	19.31	45.00	35.53
Percent Unrelated Individual Poverty	Mean Value	11.35	13.30	8.38	10.63	15.16	14.11	14.67	15.84
	Stand Dev.	5.44	1.41	2.33	1.55	5.61	4.30	6.03	6.60
	Min. Value	7.50	12.30	4.50	8.00	7.30	6.70	5.40	3.40
	Max. Value	15.20	14.30	14.40	13.20	26.40	19.30	45.00	35.50
Percent Unemployed	Mean Value	7.53	7.88	9.13	9.66	5.94	4.92	4.23	3.42
	Stand Dev.	2.30	0.19	3.76	1.97	1.29	1.35	2.00	2.25
	Min. Value	5.23	7.74	3.52	6.91	3.04	3.86	0.86	0.38
	Max. Value	12.56	8.01	17.58	13.49	8.55	8.28	13.46	13.39
Pre-1940 Housing Stock	Mean Value	12.63	6.56	15.63	17.27	9.95	11.14	18.08	23.91
	Stand Dev.	7.80	1.22	10.06	7.69	5.85	5.03	9.13	10.54
	Min. Value	3.32	5.69	3.68	11.53	1.22	5.03	3.64	4.09
	Max. Value	28.06	7.42	57.69	36.02	28.64	18.79	43.63	43.87

* Values do not include those counties in the C. Flores analysis.

TABLE A-4D

TABLE A-4E

		Regional Summaries		State-wide Summaries			
		The Nation	AZ CA FL TX	Arizona	California	Florida	Texas*
Total Local Government Revenues	Mean Value	179044944.00	104883.30	135928.71	432475.78	95522.94	30836.62
	Stand Dev.	.	479312.92	278308.49	1148249.58	203016.98	118315.88
	Min. Value	179044944.00	431.00	7912.00	2179.00	2533.00	431.00
	Max. Value	179044944.00	8408000.00	1044098.00	8408000.00	1375221.00	1383224.00
Property Tax Per Capita Property Tax	Mean Value	274.00	272.80	268.21	426.48	156.10	268.74
	Stand Dev.	.	258.06	90.47	108.25	71.87	299.56
	Min. Value	274.00	36.00	109.00	290.00	36.00	40.00
	Max. Value	274.00	3236.00	451.00	945.00	384.00	3236.00
Local Taxes as Percent of Local Revenue	Mean Value	74851555.00	44595.38	54574.21	194589.31	30521.81	13507.10
	Stand Dev.	.	223890.31	110104.55	540439.26	71063.30	61133.49
	Min. Value	74851555.00	286.00	3956.00	614.00	286.00	301.00
	Max. Value	74851555.00	3959576.00	405826.00	3959576.00	478202.00	771535.00
Local Government Expenditues Per Capita	Mean Value	778.00	695.64	764.50	1072.67	676.03	610.93
	Stand Dev.	.	318.25	105.91	225.36	145.98	314.95
	Min. Value	778.00	126.00	572.00	751.00	334.00	126.00
	Max. Value	778.00	3151.00	908.00	1934.00	1148.00	3151.00

* Values do not include those counties in the C. Flores analysis.

TABLE A-4E

TABLE A-4F

		States in the Analysis							
		Arizona		California		Florida		Texas*	
		Ag Influence		Ag Influence		Ag Influence		Ag Influence	
		- is Low-	2	- is Low-	2	- is Low-	2	- is Low-	2
Total Local Government Revenues	Mean Value	146435.00	72891.00	549870.55	171597.83	98789.62	74471.00	46578.39	8879.35
	Stand Dev.	301155.49	3165.01	1367159.69	168208.55	212957.41	127790.11	150058.27	18258.84
	Min. Value	7912.00	70653.00	2179.00	9874.00	2653.00	2533.00	1126.00	617.00
	Max. Value	1044098.00	75129.00	8408000.00	577561.00	1375221.00	378450.00	1383224.00	148423.00
Property Tax Per Capita	Mean Value	262.92	300.00	444.10	387.33	153.57	172.44	202.61	336.75
	Stand Dev.	94.70	73.54	119.51	64.58	72.66	68.15	139.62	281.17
	Min. Value	109.00	248.00	312.00	290.00	36.00	96.00	40.00	49.00
	Max. Value	451.00	352.00	945.00	524.00	386.00	315.00	792.00	1691.00
Local Taxes as Percent of Local Reveue	Mean Value	59037.17	27796.50	251533.08	68047.61	30818.43	28610.22	20575.37	3496.22
	Stand Dev.	119043.56	6402.85	643591.91	66909.23	73333.21	57802.67	77991.65	4858.22
	Min. Value	3956.00	23269.00	614.00	4106.00	286.00	359.00	476.00	400.00
	Max. Value	405826.00	32324.00	3959576.00	222041.00	478202.00	176321.00	771535.00	35640.00
Local Government Expeditures Per Capita	Mean Value	750.50	848.50	1081.12	1053.89	673.67	691.22	541.08	708.71
	Stand Dev.	108.38	12.02	253.10	150.96	141.77	179.74	216.78	324.90
	Min. Value	572.00	840.00	751.00	795.00	334.00	535.00	221.00	126.00
	Max. Value	908.00	857.00	1934.00	1345.00	1094.00	1148.00	2014.00	2396.00

* Values do not include those counties in the C. Flores analysis.

TABLE A-4F

TABLE A-4G

		Regional Summaries		State-wide Summaries			
		The Nation	AZ CA FL TX	Arizona	California	Florida	Texas*
Retail Est.	Mean Value	1855068.00	1045.19	1429.14	3239.72	1227.63	474.78
	Stand Dev.	.	3619.16	2761.34	8092.79	2259.37	1538.88
	Min. Value	1855068.00	2.00	82.00	12.00	31.00	2.00
	Max. Value	1855068.00	58995.00	10520.00	58995.00	13729.00	17324.00
Retail Est. /1000	Mean Value	8.19	1.05	1.43	3.24	1.23	0.47
	Stand Dev.	.	3.62	2.76	8.09	2.26	1.54
	Min. Value	8.19	0.00	0.08	0.01	0.03	0.00
	Max. Value	8.19	59.00	10.52	59.00	13.73	17.32
Retail Sales	Mean Value	723134221.00	423591.07	583566.64	1397549.22	468852.06	180434.71
	Stand Dev.	.	1624069.95	1290881.55	3599480.19	934388.11	758654.30
	Min. Value	723134221.00	0.00	23111.00	1304.00	3252.00	0.00
	Max. Value	723134221.00	25889383.00	4835775.00	25889383.00	5561036.00	9367110.00
Retail Sales /1000	Mean Value	3192.00	423.59	583.57	1397.55	468.85	180.43
	Stand Dev.	.	1624.07	1290.88	3599.48	934.39	758.65
	Min. Value	3192.00	0.00	23.11	1.30	3.25	0.00
	Max. Value	3192.00	25889.38	4835.27	25889.38	5561.04	9367.11

* Values do not include those counties in the C. Flores analysis.

TABLE A-4G

TABLE A-4H

		States in the Analysis							
		Arizona		California		Florida		Texas*	
		Ag Influence		Ag Influence		Ag Influence		Ag Influence	
		- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-
Retail Est.	Mean Value	1552.42	689.50	4094.87	1339.39	1257.91	1032.44	704.94	156.64
	Stand Dev.	2982.46	47.38	9627.42	1189.63	2346.34	1684.97	1941.69	281.85
	Min. Value	82.00	656.00	12.00	99.00	31.00	31.00	40.00	2.00
	Max. Value	10520.00	723.00	58995.00	4094.00	13729.00	4930.00	17324.00	2131.00
Retail Est. /1000	Mean Value	1.55	0.69	4.09	1.34	1.26	1.03	0.70	0.16
	Stand Dev.	2.98	0.05	9.63	1.19	2.35	1.68	1.94	0.28
	Min. Value	0.08	0.66	0.01	0.10	0.03	0.03	0.04	0.00
	Max. Value	10.52	0.72	59.00	4.09	13.73	4.93	17.32	2.13
Retail Sales	Mean Value	644959.92	215207.00	1792896.23	519000.33	482196.97	382851.36	277174.37	43926.19
	Stand Dev.	1392900.33	66223.38	4278856.76	504419.03	972981.49	669417.85	964241.42	98781.79
	Min. Value	23111.00	168380.00	1304.00	22939.00	3252.00	3784.00	5978.00	0.00
	Max. Value	4835775.00	262034.00	25889383.00	1788817.00	5561036.00	1949701.00	9367110.00	694716.00
Retail Sales /1000	Mean Value	644.96	215.21	1792.90	519.00	482.20	382.85	277.17	43.93
	Stand Dev.	1392.90	66.22	4278.86	504.42	972.98	669.42	964.24	98.78
	Min. Value	23.11	168.38	1.30	22.94	3.25	3.78	5.98	0.00
	Max. Value	4835.77	262.03	25889.38	1788.82	5561.04	1949.70	9367.11	694.72

* Values do not include those counties in the C. Flores analysis.

TABLE A-4H

TABLE A-4I

		Regional Summaries		State-wide Summaries			
		The Nation	AZ CA FL TX	Arizona	California	Florida	Texas*
Wholesale Est.	Mean Value	382837.00	208.83	256.21	632.83	229.99	103.82
	Stand Dev.	-	896.20	613.23	1957.77	601.75	463.26
	Min. Value	382837.00	0.00	3.00	0.00	1.00	0.00
	Max. Value	382837.00	14499.00	2331.00	14499.00	6278.00	5134.00
Wholesale Est. /1000 Pop.	Mean Value	1.69	0.21	0.26	0.63	0.23	0.10
	Stand Dev.	-	0.90	0.61	1.96	0.60	0.46
	Min. Value	1.69	0.00	0.00	0.00	0.00	0.00
	Max. Value	1.69	14.50	2.33	14.50	6.28	5.13
Wholesale Sales	Mean Value	1258400268	656669.10	377989.14	2212122.86	511319.16	344163.77
	Stand Dev.	-	3784750.47	1640568.38	8057284.75	1506492.69	2486083.09
	Min. Value	1258400268	0.00	3010.00	0.00	0.00	0.00
	Max. Value	1258400268	59730425.00	6219529.00	59730425.00	8681120.00	29990798.00
Wholesale Sales /1000 Pop.	Mean Value	5554.73	656.67	377.99	2212.12	511.32	344.16
	Stand Dev.	-	3784.75	1640.57	8057.28	1506.49	2486.08
	Min. Value	5554.73	0.00	3.01	0.00	0.00	0.00
	Max. Value	5554.73	59730.42	6219.53	59730.42	8681.12	29990.80

* Values do not include those counties in the C. Flores analysis.

TABLE A-4I

TABLE A-4J

		States in the Analysis							
		Arizona		California		Florida		Texas*	
		Ag Influence		Ag Influence		Ag Influence		Ag Influence	
		- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-
Wholesale Est.	Mean Value	282.08	101.00	811.28	236.28	242.53	149.11	154.46	33.75
	Stand Dev.	662.70	39.60	2338.85	246.91	640.30	240.15	390.91	54.37
	Min. Value	3.00	73.00	0.00	17.00	3.00	1.00	2.00	0.00
	Max. Value	2331.00	129.00	14499.00	988.00	4278.00	673.00	5134.00	396.00
Wholesale Est. /100,000	Mean Value	0.28	0.10	0.81	0.24	0.24	0.15	0.15	0.03
	Stand Dev.	0.66	0.04	2.34	0.25	0.64	0.24	0.59	0.06
	Min. Value	0.00	0.07	0.00	0.02	0.00	0.00	0.00	0.00
	Max. Value	2.33	0.13	14.50	0.99	4.28	0.67	5.13	0.40
Wholesale Sales	Mean Value	647980.33	158042.00	2944904.92	583718.28	554621.05	232262.36	541449.23	57986.00
	Stand Dev.	1772754.99	90997.57	9634484.09	808530.44	1608305.03	377906.98	3190927.75	120003.79
	Min. Value	3010.00	93697.00	0.00	0.00	0.00	0.00	0.00	0.00
	Max. Value	6219529.00	222387.00	59730425.00	2994913.00	8681120.00	947219.00	29990798.00	759966.00
Wholesale Sales /100,000	Mean Value	647.98	158.04	2944.90	583.72	554.62	232.26	541.45	57.99
	Stand Dev.	1772.75	91.00	9634.48	808.53	1608.31	377.91	3190.93	120.00
	Min. Value	3.01	93.70	0.00	0.00	0.00	0.00	0.00	0.00
	Max. Value	6219.53	222.39	59730.42	2994.91	8681.12	947.22	29990.80	759.97

* Values do not include those countries in the C. Flores analysis.

TABLE A-4J

TABLE A-4K

		Regional Summaries		State-wide Summaries			
		The Nation	AZ CA FL TX	Arizona	California	Florida	Texas*
Percent Employed in Manufacturing	Mean Value	22.44	12.98	10.73	13.07	13.30	13.00
	Stand Dev.	.	7.57	7.01	5.91	6.34	8.23
	Min. Value	22.44	0.00	3.51	3.46	4.30	0.00
	Max. Value	22.44	35.48	30.83	35.48	33.78	33.29
Percent Employed in Selected Services	Mean Value	20.29	18.38	20.54	20.16	18.70	17.78
	Stand Dev.	.	4.19	5.73	3.40	4.01	4.16
	Min. Value	20.29	6.67	12.15	9.66	13.42	6.67
	Max. Value	20.29	39.84	34.12	32.90	39.84	38.26

* Values do not include those counties in the C. Flores analysis.

TABLE A-4K

TABLE A-4L

		States in the Analysis							
		Arizona		California		Florida		Texas*	
		Ag Influence		Ag Influence		Ag Influence		Ag Influence	
		- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-	- is Low-	- is High-
Percent employed in Manufacturing	Mean Value	11.11	8.48	13.89	11.24	13.77	10.31	16.27	8.48
	Stand Dev.	7.46	3.81	6.45	4.05	6.57	3.47	7.78	5.82
	Min. Value	3.51	5.79	3.46	5.60	4.30	5.75	0.48	0.53
	Max. Value	30.83	11.18	35.48	19.79	33.78	15.51	33.29	24.38
Percent Employed in Selective Services	Mean Value	20.91	18.31	19.91	20.71	18.76	18.32	18.31	17.05
	Stand Dev.	6.13	1.33	3.20	3.84	4.06	3.84	4.34	3.60
	Min. Value	12.15	17.36	9.66	15.80	13.42	14.79	10.23	8.97
	Max. Value	34.12	19.25	26.91	32.90	39.84	27.65	38.26	25.87

* Values do not include counties in the C. Flores analysis.

TABLE A-4L

TABLE A-5A

MACROSOCIAL ACCOUNTING PROJECT - U·C· DAVIS

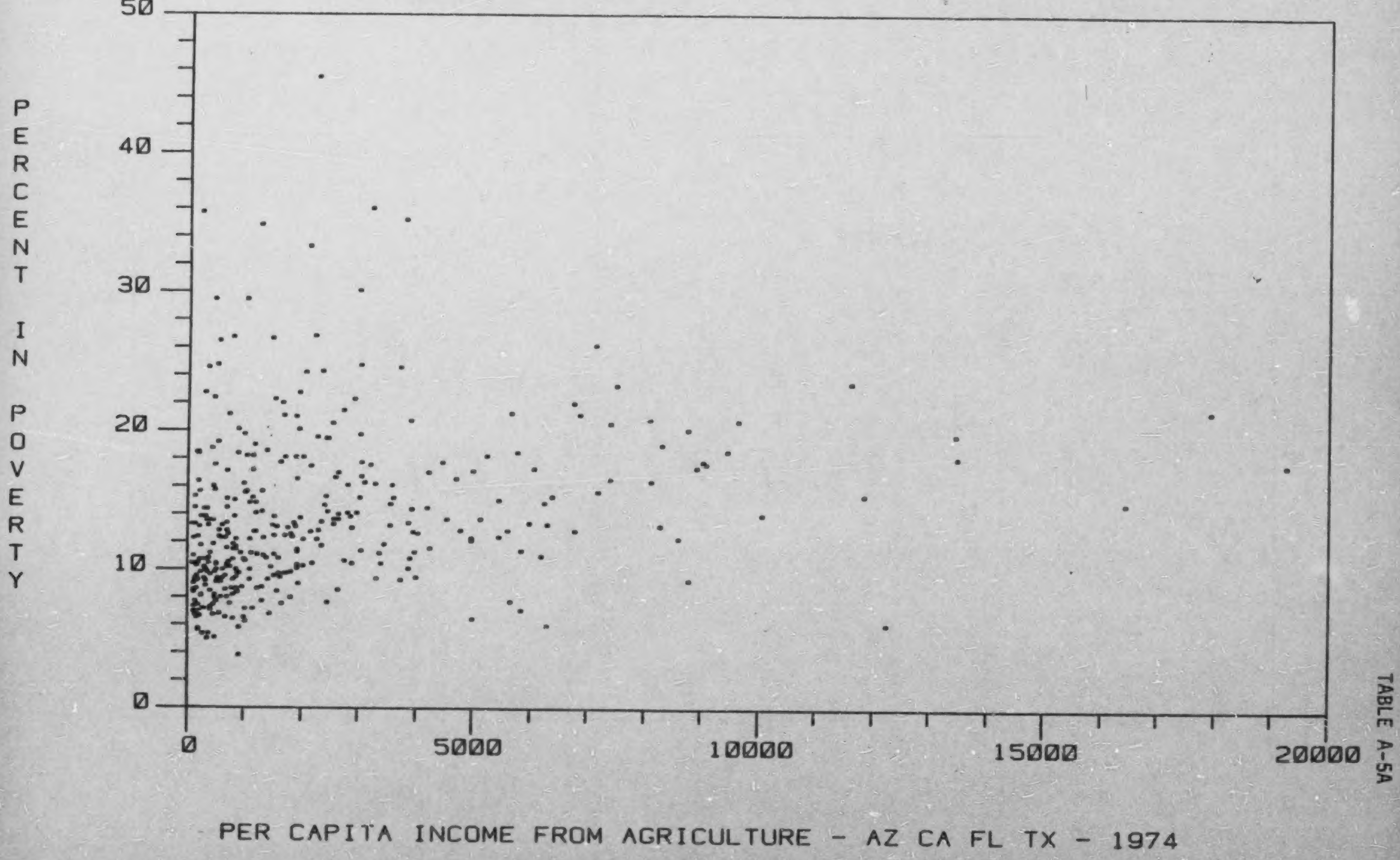
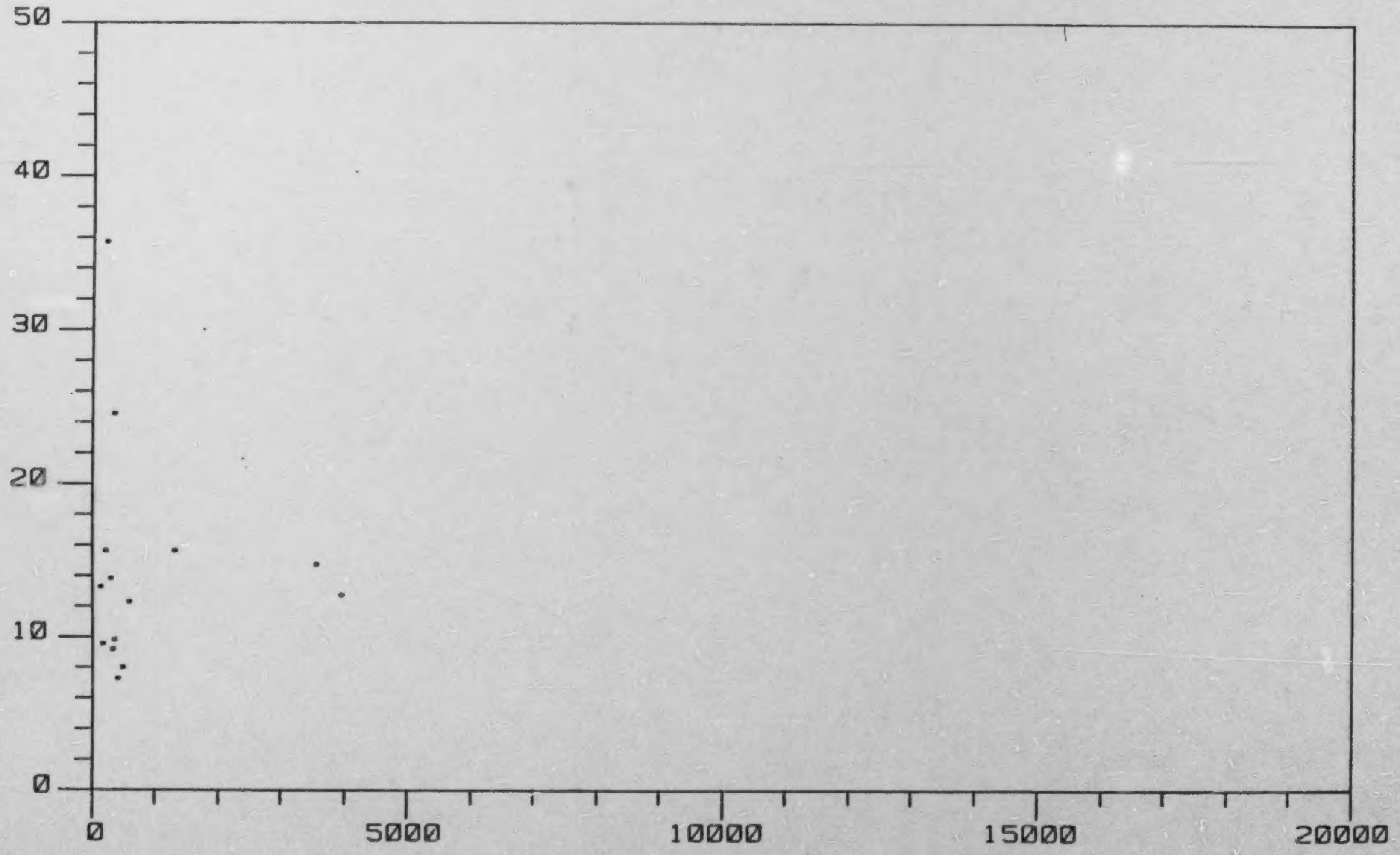


TABLE A-5A

TABLE A-5B

MACROSOCIAL ACCOUNTING PROJECT - U·C· DAVIS

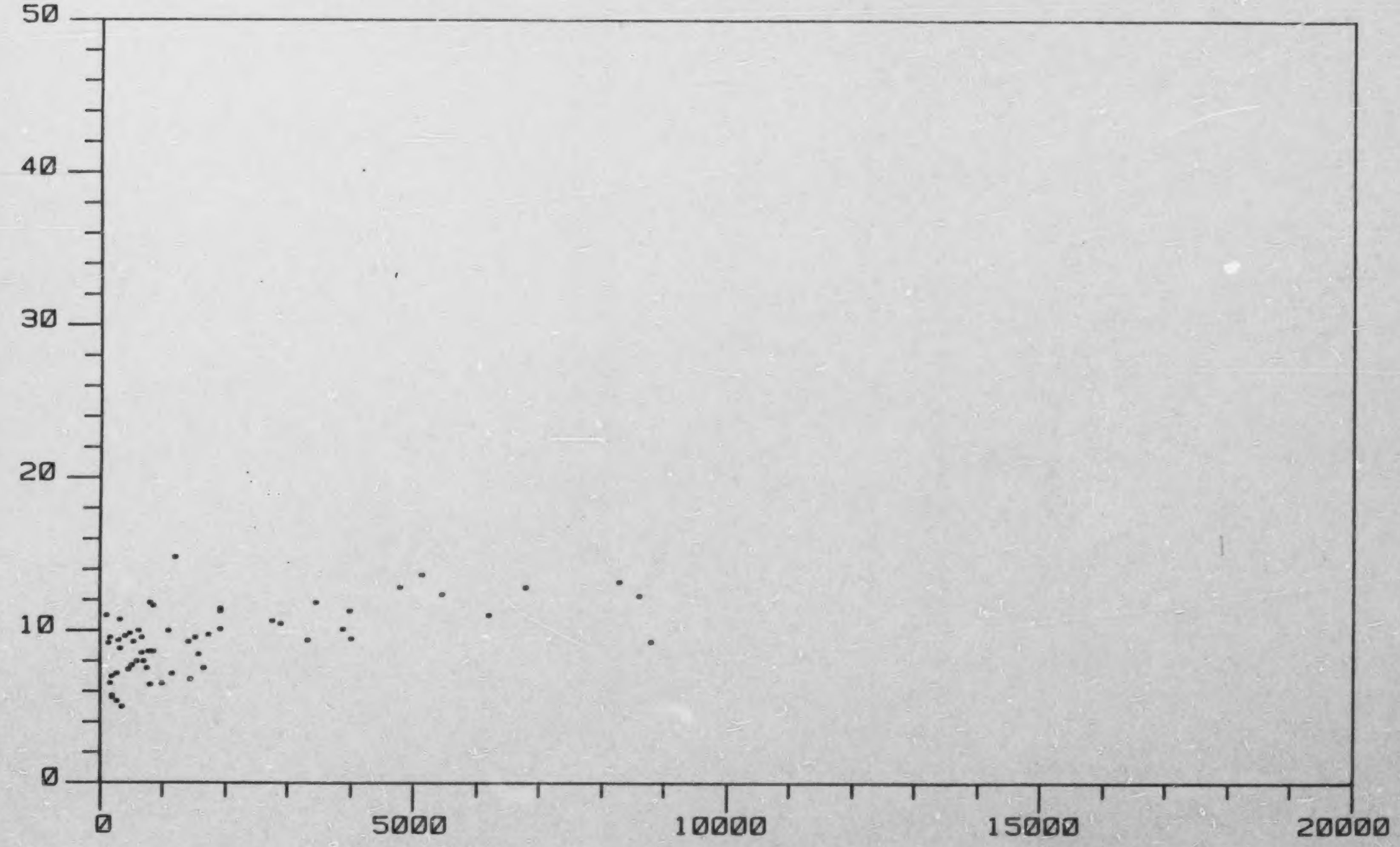


PER CAPITA INCOME FROM AGRICULTURE - AZ - 1974

TABLE A-5B

TABLE A-5C

MACROSOCIAL ACCOUNTING PROJECT - U·C· DAVIS

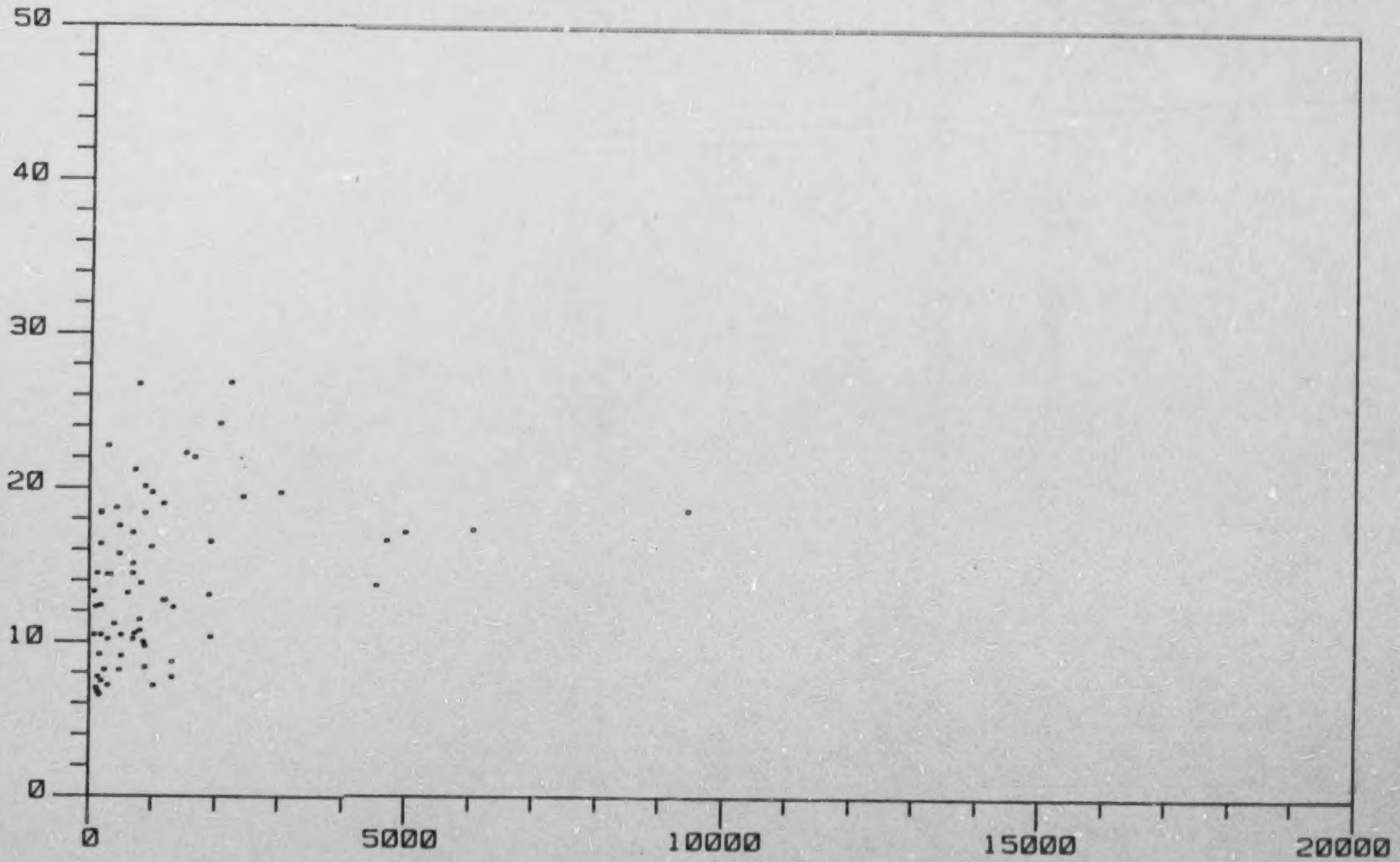


PER CAPITA INCOME FROM AGRICULTURE - CA - 1974

TABLE A-5C

TABLE A-5D

MACROSOCIAL ACCOUNTING PROJECT - U·C· DAVIS

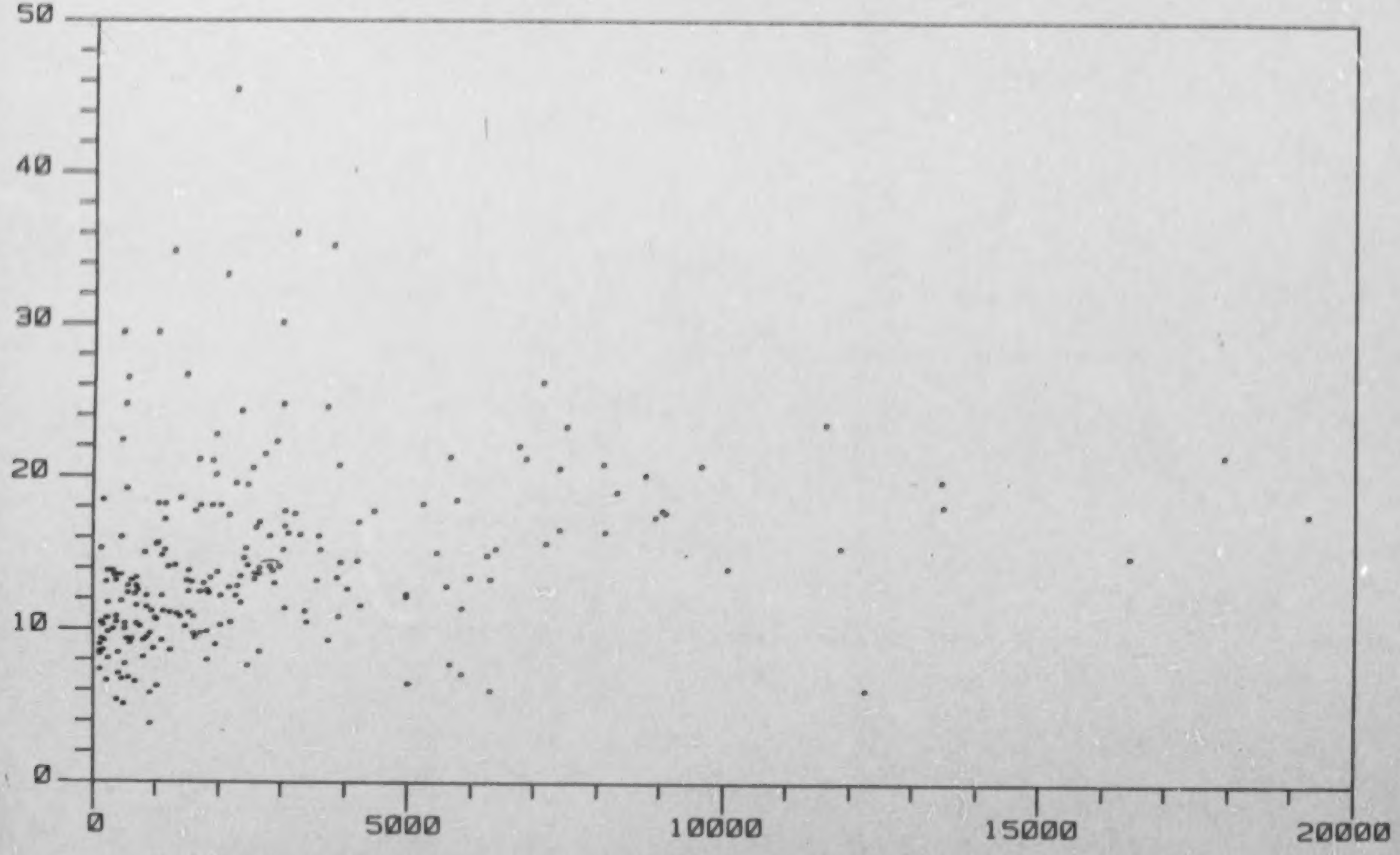


PER CAPITA INCOME FROM AGRICULTURE - FL - 1974

TABLE A-5D

TABLE A-5E

MACROSOCIAL ACCOUNTING PROJECT - U.C. DAVIS



PER CAPITA INCOME FROM AGRICULTURE - TX - 1974

TABLE A-5E

TABLE A-6

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BMDP1R Page   3




 REGRESSION TITLE IS                 INDIVIDUAL POVERTY REGRESSED ON MEAN FARM SIZE  (ACRES) IN 1970.

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .      38 POVIND70
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R            0.1808           STD. ERROR OF EST.        11.5549
 MULTIPLE R-SQUARE     0.0327

 ANALYSIS OF VARIANCE
                      SUM OF SQUARES     DF     MEAN SQUARE       F RATIO    P(TAIL)
          REGRESSION       378.8256       1        378.8256         2.837     0.0958
          RESIDUAL       11215.3047      84        133.5155

                                                STD. REG
    VARIABLE       COEFFICIENT  STD. ERROR        COEFF          T   P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT            49.64344
 D1003       5    -0.11205E-02 0.66523E-03        -0.181    -1.684    0.0958     1.00000 1970: Average farm size (acres)

 Number of integer words of storage used in preceding    problem 3912
 Elapsed time:      1.82 minutes.
```

TABLE A-6

TABLE A-7

```
BMDP1R Page   4

 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  09-APR-85 at 11:11:11

 REGRESSION TITLE IS                     INDIVIDUAL POVERTY REGRESSED ON MEAN FARM SIZE  (ACRES) IN 1970.
   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .      37 POVIND80
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R              0.2716
 MULTIPLE R-SQUARE       0.0738           STD. ERROR OF EST.         5.8002

 ANALYSIS OF VARIANCE
                       SUM OF SQUARES       DF      MEAN SQUARE        F RATIO     P(TAIL)
          REGRESSION         225.0533        1         225.0533          6.690      0.0114
          RESIDUAL          2825.9189       84          33.6419

    VARIABLE          COEFFICIENT   STD. ERROR        STD. REG
                                                        COEFF          T    P(2 TAIL) TOLERANCE    VARIABLE LABEL...
 INTERCEPT                13.49757
 D1003        5       0.86367E-03 0.33392E-03          0.272       2.586     0.0114      1.00000 1970: Average farm size (acres)
 Number of integer words of storage used in preceding    problem 3912
 Elapsed time:      0.03 minutes.
```

TABLE A-7

TABLE A-8

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BMDP1R Page   6

 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  09-APR-85 at 11:11:16

 REGRESSION TITLE IS    PROPORTIONAL CHANGE IN INDIVIDUAL POVERTY  (FROM 1970 TO 1980)  REGRESSED ON MEAN FARM SIZE (ACRES) IN 1970.

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .      36 POVIND78
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R             0.5502           STD. ERROR OF EST.        11.0579
 MULTIPLE R-SQUARE      0.3028

 ANALYSIS OF VARIANCE
                       SUM OF SQUARES      DF     MEAN SQUARE       F RATIO     P(TAIL)
          REGRESSION       4406.7285        2       2203.3643        18.020      0.0000
          RESIDUAL        10148.9258       83        122.2762

                                                       STD. REG
    VARIABLE        COEFFICIENT   STD. ERROR            COEFF          T   P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT              -61.07888
 D1003         5     0.32387E-02 0.64728E-03          0.466      5.004     0.0000      0.96733 1970: Average farm size (acres)
 POVIND70     38        -0.24622     0.10442         -0.220     -2.358     0.0207      0.96733 1970: % Individuals below poverty line

 Number of integer words of storage used in preceding    problem 3912
  Elapsed time:      0.05 minutes.
```

TABLE A-8

TABLE A-9

Table A-9

Matrix of Intercorrelations Between Independent Variables

(1970 Data)

	1	2	3	4	5	6	7	8	9
1. percent corporate		.18	.61	.46	.85	.83	.66	.83	.82
2. average size			.42	-.13	.21	-.02	.06	-.06	-.02
3. $40k plus sales				.40	.72	.57	.74	.62	.64
4. full-time labor					.65	.62	.39	.54	.60
5. labor cost						.79	.80	.90	.91
6. contract labor							.95	.95	.79
7. machines cost								.85	.80
8. fertilizer cost									.93
9. chemical cost									

Table A-10

Auto-correlations:

Concentration in 1970 X Change in Concentration 1970-1980

	Change 70-80
1. percent corporate	-.29
2. average size	-.24
3. $40k plus sales	-.43
4. full-time labor	.23
5. labor cost	-.15 not significant
6. contract labor	.08 not significant
7. machines cost	-.31
8. fertilizer cost	-.35
9. chemical cost	-.31

APPENDIX B

List of Counties in Study

Appendix B-1A

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Arizona

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
03	001	Apache	52108.	6592.	127.	35.3
03	002	Cochise	85686.	44249.	516.	11.8
03	003	Coconino	75008.	10614.	142.	15.2
03	004	Gila	37080.	2155.	58.	12.8
03	005	Graham	22862.	27925.	1221.	15.2
03	006	Greenlee	11406.	3626.	318.	6.8
03	007	Maricopa	1509052.	623185.	413.	7.5
03	008	Mohave	55865.	13452.	241.	8.7
03	009	Navajo	67629.	18653.	276.	24.1
03	010	Pima	531443.	41298.	78.	9.1
03	011	Pinal	90918.	314146.	3455.	14.3
03	012	Santa Cruz	20459.	4145.	203.	13.4
03	013	Yavapai	68145.	17561.	258.	9.4
03	014	Yuma	90554.	349504.	3859.	12.3

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

California

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
05	001	Alameda	1105379.	56281.	51.	8.7
05	002	Alpine	1097.	-9.	-9.	18.1
05	003	Amador	19314.	9772.	506.	7.5
05	004	Butte	143851.	146050.	1015.	9.5
05	005	Calaveras	20710.	12437.	600.	7.5
05	006	Colusa	12791.	111338.	8704.	8.8
05	007	Contra Costa	656380.	60664.	92.	6.1
05	008	Del Norte	18217.	13168.	723.	11.4
05	009	El Dorado	85812.	15339.	179.	6.7
05	010	Fresno	514612.	1723910.	3349.	11.4
05	011	Glenn	21350.	130567.	6115.	10.5
05	012	Humboldt	108514.	44186.	407.	9.4
05	013	Imperial	92110.	755165.	8198.	12.7
05	014	Inyo	17895.	7452.	416.	7.3
05	015	Kern	403089.	1070405.	2655.	10.2
05	016	Kings	73738.	492615.	6680.	12.4
05	017	Lake	36366.	28143.	773.	11.2
05	018	Lassen	21661.	34146.	1576.	7.1
05	019	Los Angeles	7477503.	283273.	38.	10.5
05	020	Madera	63116.	294954.	4681.	12.4
05	021	Marin	222568.	43306.	194.	4.9
05	022	Mariposa	11108.	20349.	1831.	9.6
05	023	Mendocino	66738.	36429.	545.	9.5
05	024	Merced	134560.	720992.	5358.	11.9
05	025	Modoc	8610.	73153.	8496.	11.8
05	026	Mono	8577.	11605.	1353.	6.4
05	027	Monterey	290444.	939619.	3235.	8.9
05	028	Napa	99199.	72757.	733.	6.0
05	029	Nevada	51645.	5642.	109.	6.5
05	030	Orange	1932709.	214160.	110.	5.2
05	031	Placer	117247.	44702.	381.	7.0
05	032	Plumas	17340.	12183.	702.	8.2
05	033	Riverside	663166.	887272.	1337.	8.8
05	034	Sacramento	783381.	167772.	214.	8.9
05	035	San Benito	25005.	97173.	3886.	10.8
05	036	San Bernardino	895016.	532331.	594.	9.1
05	037	San Diego	1861846.	449649.	241.	8.4
05	038	San Francisco	678974.	1618.	238.	10.3
05	039	San Joaquin	347342.	637712.	1835.	10.8
05	040	San Luis Obispo	155435.	231432.	1488.	8.0
05	041	San Mateo	587329.	154673.	263.	4.5
05	042	Santa Barbara	298694.	318822.	1067.	6.7
05	043	Santa Clara	1295071.	123284.	95.	5.3
05	044	Santa Cruz	188141.	147498.	783.	8.2
05	045	Shasta	115715.	53680.	463.	8.8

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

California

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
05	046	Sierra	3073.	5062.	1647.	9.3
05	047	Siskiyou	39732.	150282.	3782.	9.6
05	048	Solano	235203.	136461.	580.	8.1
05	049	Sonoma	299681.	197771.	659.	7.1
05	050	Stanislaus	265900.	731182.	2794.	10.0
05	051	Sutter	52246.	205335.	3930.	9.0
05	052	Tehama	38888.	72051.	1852.	11.0
05	053	Trinity	11858.	994.	83.	9.1
05	054	Tulare	245738.	1241831.	5053.	13.2
05	055	Tuolumne	33928.	10544.	310.	9.2
05	056	Ventura	529174.	481130.	909.	6.1
05	057	Yolo	113374.	162209.	1430.	9.1
05	058	Yuba	49733.	56334.	1132.	14.4

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Florida

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
09	001	Alachua	151348.	32516.	215.	13.9
09	002	Baker	15289.	16973.	1110.	12.3
09	003	Bay	97740.	1064.	11.	12.8
09	004	Bradford	20023.	16220.	810.	17.9
09	005	Brevard	272959.	17933.	66.	7.3
09	006	Broward	1018200.	44498.	44.	6.3
09	007	Calhoun	9294.	7434.	799.	19.6
09	008	Charlotte	58640.	12991.	222.	6.7
09	009	Citrus	54703.	5469.	99.	10.0
09	010	Clay	67052.	27887.	415.	8.6
09	011	Collier	85971.	66128.	769.	9.5
09	012	Columbia	35399.	14381.	406.	15.3
09	013	Dade	1625781.	177617.	109.	11.9
09	014	De Soto	19039.	35026.	1839.	16.1
09	015	Dixie	7751.	1656.	213.	22.3
09	016	Duval	571003.	30425.	532.	12.7
09	017	Escambia	233794.	11817.	51.	14.0
09	018	Flagler	10913.	9561.	1248.	11.8
09	019	Franklin	7661.	-9.	-9.	23.6
09	020	Gadsden	41565.	29335.	705.	26.3
09	021	Gilchrist	5767.	26649.	4620.	16.1
09	022	Glades	5992.	29438.	4912.	16.6
09	023	Gulf	10658.	3653.	342.	18.3
09	024	Hamilton	8761.	12707.	1450.	21.8
09	025	Hardee	19379.	57091.	2946.	19.3
09	026	Hendry	18599.	111228.	5980.	16.8
09	027	Hernando	44469.	27659.	621.	9.7
09	028	Highlands	47526.	85640.	1801.	12.6
09	029	Hillsborough	646960.	214709.	331.	10.7
09	030	Holmes	14723.	23303.	1582.	21.5
09	031	Indian River	59896.	74126.	1237.	8.3
09	032	Jackson	39154.	43041.	1099.	18.5
09	033	Jefferson	10703.	21203.	1981.	23.7
09	034	Lafayette	4035.	37774.	9361.	18.1
09	035	Lake	104870.	194272.	1852.	9.9
09	036	Lee	205266.	35263.	171.	7.7
09	037	Leon	148655.	5226.	35.	11.8
09	038	Levy	19870.	12273.	617.	16.6
09	039	Liberty	4260.	484.	113.	17.9
09	040	Madison	14894.	31576.	2120.	26.4
09	041	Manatee	148442.	118527.	798.	7.9
09	042	Marion	122488.	75718.	618.	14.0
09	043	Martin	64014.	79279.	1238.	7.3
09	044	Monroe	63188.	207.	3.	10.0
09	045	Nassau	32894.	21101.	641.	10.1

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

xx

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
09	046	Okaloosa	109920.	7782.	70.	8.7
09	047	Okeechobee	20264.	89982.	4440.	13.2
09	048	Orange	471016.	195974.	416.	10.0
09	049	Osceola	49287.	39115.	793.	9.3
09	050	Palm Beach	576863.	532281.	922.	6.7
09	051	Pasco	193643.	79545.	410.	7.7
09	052	Pinellas	728531.	10133.	14.	6.5
09	053	Polk	321652.	227682.	707.	10.3
09	054	Putnam	50549.	20071.	397.	17.1
09	055	St Johns	51303.	37364.	728.	11.0
09	056	St Lucie	87182.	94288.	1081.	12.3
09	057	Santa Rosa	55988.	15297.	273.	13.9
09	058	Sarasota	202251.	13619.	67.	6.1
09	059	Seminole	179752.	19344.	107.	7.0
09	060	Sumter	24272.	21819.	898.	15.7
09	061	Suwannee	22287.	52302.	2346.	19.0
09	062	Taylor	16532.	1806.	109.	18.0
09	063	Union	10166.	7623.	749.	13.4
09	064	Volusia	258762.	57857.	223.	9.7
09	065	Wakulla	10887.	1245.	114.	15.9
09	066	Walton	21300.	19341.	908.	19.3
09	067	Washington	14509.	9183.	632.	20.7

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Texas

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
43	001	Anderson	38381.	23065.	600.	14.6
43	002	Andrews	13323.	9762.	732.	8.8
43	003	Angelina	64172.	8160.	127.	10.3
43	004	Aransas	14260.	1894.	132.	12.6
43	005	Archer	7266.	33431.	4601.	6.2
43	006	Amstrong	1994.	23683.	11877.	8.0
43	007	Atascosa	25055.	47099.	1879.	19.6
43	008	Austin	17726.	34602.	1952.	11.7
43	009	Bailey	8168.	71993.	8814.	16.9
43	010	Bandera	7084.	6608.	932.	10.2
43	011	Bastrop	24726.	24944.	1010.	14.4
43	012	Baylor	4919.	20490.	4165.	11.1
43	013	Bee	26030.	27649.	1062.	17.7
43	014	Bell	157889.	27370.	173.	13.4
43	015	Bexar	988800.	41138.	41.	14.8
43	016	Blanco	4681.	11158.	2383.	7.2
43	017	Borden	859.	14043.	16348.	14.4
43	018	Bosque	13401.	25220.	1881.	11.4
43	019	Bowie	75301.	36295.	482.	12.4
43	020	Brazoria	169587.	62147.	366.	6.3
43	021	Brazos	93588.	28013.	299.	10.4
43	022	Brewster	7573.	17865.	2359.	14.8
43	023	Briscoe	2579.	21202.	8221.	18.5
43	024	Brooks	8428.	11605.	1377.	26.2
43	025	Brown	33057.	27608.	835.	9.3
43	026	Burleson	12313.	29184.	2370.	13.7
43	027	Burnet	17803.	13899.	780.	11.7
43	028	Caldwell	23637.	30665.	1297.	18.1
43	029	Calhoun	19574.	19805.	1011.	11.7
43	030	Callahan	10992.	15320.	1393.	9.7
43	031	Cameron	209727.	95078.	453.	26.0
43	032	Camp	9275.	31163.	3359.	13.7
43	033	Carson	6672.	38464.	5765.	6.6
43	034	Cass	29430.	21931.	745.	14.5
43	035	Castro	10556.	188243.	17832.	21.0
43	036	Chambers	18538.	40382.	2178.	11.7
43	037	Cherokee	38127.	46959.	1231.	13.7
43	038	Childress	6950.	20568.	2959.	10.9
43	039	Clay	9582.	34971.	3649.	8.8
43	040	Cochran	4825.	38655.	8011.	20.4
43	041	Coke	3196.	8638.	2702.	7.7
43	042	Coleman	10439.	25869.	2478.	12.8
43	043	Collin	144576.	41300.	285.	4.9
43	044	Collingsworth	4648.	31485.	6773.	20.7
43	045	Colorado	18823.	60011.	3188.	15.7

Appendix B-1G

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Texas

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
43	046	Comal	36446.	6122.	168.	7.6
43	047	Comanche	12617.	61624.	4884.	11.8
43	048	Concho	2915.	18367.	6300.	14.8
43	049	Cooke	27656.	41953.	1517.	9.3
43	050	Coryell	56767.	26548.	467.	11.9
43	051	Cottle	2947.	21111.	7103.	15.2
43	052	Crane	4600.	1061.	230.	9.5
43	053	Crockett	4608.	15067.	3269.	10.7
43	054	Crosby	8859.	65648.	7410.	22.8
43	055	Culberson	3315.	9854.	2972.	17.3
43	056	Dallam	6531.	76778.	11755.	14.9
43	057	Dallas	1556390.	27085.	17.	7.9
43	058	Dawson	16184.	47378.	2927.	14.7
43	059	Deaf Smith	21165.	233705.	11042.	14.3
43	060	Delta	4839.	12351.	2552.	13.5
43	061	Denton	143126.	55487.	387.	4.6
43	062	De Witt	18903.	36869.	1950.	17.6
43	063	Dickens	3539.	25863.	7308.	20.1
43	064	Dimmit	11367.	23182.	2039.	32.8
43	065	Donley	4075.	26977.	6620.	15.2
43	066	Duval	12517.	36657.	2928.	24.3
43	067	Eastland	19480.	29219.	1499.	12.6
43	068	Ector	115374.	3119.	27.	8.5
43	069	Edwards	2033.	17558.	8636.	23.8
43	070	Ellis	59743.	40604.	679.	9.7
43	071	El Paso	479899.	38544.	80.	18.0
43	072	Erath	22560.	86255.	3823.	10.4
43	073	Falls	17946.	31137.	1735.	19.3
43	074	Fannin	24285.	39635.	1632.	12.0
43	075	Fayette	18832.	46945.	2492.	13.2
43	076	Fisher	5891.	36543.	6203.	12.8
43	077	Floyd	9834.	93878.	9546.	20.3
43	078	Foard	2158.	14797.	6856.	14.7
43	079	Fort Bend	130846.	62688.	479.	6.4
43	080	Franklin	6893.	22850.	3315.	10.0
43	081	Freestone	14830.	21021.	1417.	12.7
43	082	Frio	13785.	50123.	3636.	24.1
43	083	Gaines	13150.	95993.	7299.	16.1
43	084	Galveston	195940.	6446.	32.	8.0
43	085	Garza	5336.	20444.	3831.	13.9
43	086	Gillespie	13532.	28438.	2101.	10.0
43	087	Glasscork	1304.	17452.	13383.	17.6
43	088	Goliad	5193.	19043.	3667.	16.2
43	089	Gonzales	16883.	150645.	8922.	17.4
43	090	Gray	26386.	45860.	1738.	7.5

Appendix B-1H

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Texas

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
43	091	Grayson	89796.	38219.	425.	7.3
43	092	Gregg	99487.	6025.	60.	10.0
43	093	Grimes	13580.	38249.	2816.	21.8
43	094	Guadalupe	46708.	29004.	621.	12.9
43	095	Hale	37592.	155525.	4137.	16.5
43	096	Hall	5594.	37302.	6668.	21.5
43	097	Hamilton	8297.	29099.	3507.	14.7
43	098	Hansford	6209.	105498.	16991.	8.4
43	099	Hardeman	6368.	25159.	3950.	12.2
43	100	Hardin	40721.	4051.	99.	8.8
43	101	Harris	2409549.	49829.	20.	8.1
43	102	Harrison	52269.	15938.	304.	13.1
43	103	Hartley	3987.	95818.	24032.	8.7
43	104	Haskell	7725.	41391.	5358.	14.5
43	105	Hays	40594.	10524.	259.	13.1
43	106	Hemphill	5304.	26041.	4909.	6.0
43	107	Henderson	42606.	38809.	910.	10.3
43	108	Hidalgo	283229.	261470.	922.	29.0
43	109	Hill	25024.	42195.	1686.	12.5
43	110	Hockley	23230.	81213.	3496.	15.6
43	111	Hood	17714.	16576.	935.	5.8
43	112	Hopkins	25247.	123133.	4877.	11.6
43	113	Houston	22299.	35516.	1592.	20.6
43	114	Howard	33142.	20711.	624.	12.4
43	115	Hudspeth	2728.	19208.	7041.	25.7
43	116	Hunt	55428.	32955.	596.	11.8
43	117	Hutchinson	26304.	21493.	815.	5.4
43	118	Irion	1386.	6450.	4653.	11.5
43	119	Jack	7408.	12820.	1730.	9.4
43	120	Jackson	13352.	50522.	3783.	12.9
43	121	Jasper	30781.	8844.	287.	12.7
43	122	Jeff Davis	1647.	14274.	8666.	19.6
43	123	Jefferson	250938.	37788.	150.	10.3
43	124	Jim Hog	5168.	15475.	2994.	21.8
43	125	Jim Wells	36498.	34881.	955.	17.7
43	126	Johnson	67649.	40405.	597.	6.1
43	127	Jones	17268.	35915.	2079.	12.3
43	128	Karnes	13593.	32392.	2383.	19.0
43	129	Kaufman	39013.	29791.	763.	11.0
43	130	Kendall	10635.	13849.	1302.	10.4
43	131	Kenedy	543.	14471.	26650.	29.5
43	132	Kent	1145.	10299.	8994.	17.2
43	133	Kerr	28780.	9305.	323.	8.0
43	134	Kimble	4063.	11402.	2806.	12.5
43	135	King	425.	12350.	29058.	12.7

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Texas

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
43	136	Kinney	2279.	11106.	4873.	29.0
43	137	Kleberg	33358.	35908.	1076.	16.7
43	138	Knox	5329.	27405.	5142.	17.7
43	139	Lamar	42156.	38852.	921.	15.1
43	140	Lamb	18668.	149922.	8031.	15.9
43	141	Lampasos	12005.	17218.	1434.	13.4
43	142	La Salle	5514.	17186.	3116.	35.5
43	143	Lavaca	19004.	43318.	2279.	13.0
43	144	Lee	10952.	29925.	2732.	14.3
43	145	Leon	9594.	36691.	3824.	20.3
43	146	Liberty	47088.	40614.	862.	10.7
43	147	Limestone	20224.	31518.	1558.	17.3
43	148	Lipscomb	3766.	21724.	5768.	10.9
43	149	Live Oak	9606.	24636.	2564.	13.2
43	150	Llano	10144.	19059.	1878.	8.5
43	151	Loving	-9.	1029.	11307.	-9.0
43	152	Lubbock	211651.	130050.	614.	9.9
43	153	Lynn	8605.	47966.	5574.	20.8
43	154	McCulloch	8735.	22411.	2565.	16.5
43	155	McLennon	170755.	62309.	364.	11.4
43	156	McMullen	789.	9596.	12162.	5.6
43	157	Madison	10649.	36816.	3457.	16.7
43	158	Marion	10360.	3813.	368.	21.9
43	159	Martin	4684.	25864.	5521.	12.4
43	160	Mason	3683.	26399.	7167.	13.0
43	161	Matagorda	37828.	73191.	1934.	9.8
43	162	Maverick	31398.	36654.	1167.	34.4
43	163	Medina	23164.	37517.	1619.	17.6
43	164	Menard	2346.	16618.	7083.	22.3
43	165	Midland	82636.	11436.	138.	6.2
43	166	Milam	22732.	47434.	2086.	17.0
43	167	Mills	4477.	28944.	6465.	14.0
43	168	Mitchell	9088.	22717.	2499.	16.2
43	169	Montague	17410.	26371.	1514.	10.4
43	170	Montgomery	128487.	16988.	132.	6.2
43	171	Moore	16575.	92273.	5567.	7.3
43	172	Morris	14629.	9182.	627.	12.1
43	173	Motley	1950.	22442.	11508.	23.0
43	174	Nacogdoches	46786.	84079.	1797.	12.9
43	175	Navarro	35323.	35225.	9972.	13.5
43	176	Newton	13254.	3936.	2970.	16.3
43	177	Nolan	17359.	30716.	1769.	11.9
43	178	Nueces	268215.	62528.	233.	13.4
43	179	Ochiltree	9588.	59693.	6225.	5.5
43	180	Oldham	2283.	25069.	10980.	5.9

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Texas

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
43	181	Orange	83838.	7335.	87.	8.2
43	182	Palo Pinto	24062.	12780.	531.	8.9
43	183	Panola	20724.	46842.	2260.	11.3
43	184	Parker	44609.	34634.	776.	9.0
43	185	Parmer	11038.	211637.	19173.	17.2
43	186	Pecos	14618.	25160.	1721.	12.1
43	187	Polk	24407.	9306.	381.	15.5
43	188	Potter	98637.	8694.	88.	9.8
43	189	Presidio	5188.	17246.	3324.	34.6
43	190	Rains	4839.	13190.	2725.	13.6
43	191	Randall	75062.	63047.	839.	3.4
43	192	Reagan	4135.	9178.	2219.	12.4
43	193	Real	2469.	5208.	2109.	23.9
43	194	Red River	16101.	29077.	1805.	20.5
43	195	Reeves	15801.	41645.	2635.	21.0
43	196	Refugio	9289.	25755.	2772.	13.4
43	197	Roberts	1187.	11622.	9797.	8.3
43	198	Robertson	14653.	35975.	2455.	20.1
43	199	Rockwall	14528.	4741.	326.	6.6
43	200	Runnels	11872.	48827.	4112.	14.0
43	201	Rusk	41382.	25765.	622.	11.1
43	202	Sabine	8702.	15845.	1820.	17.6
43	203	San Augustine	8785.	19150.	2179.	19.1
43	254	San Jacinto	11434.	5198.	454.	18.7
43	204	San Patricio	58013.	61525.	1060.	14.7
43	205	San Saba	6204.	35167.	5668.	18.0
43	206	Schleicher	2820.	12657.	4488.	13.4
43	207	Scurry	18192.	28354.	1558.	9.0
43	208	Shackelford	3915.	10057.	2568.	8.1
43	209	Shelby	23084.	72085.	3122.	17.1
43	210	Sherman	3174.	83697.	26369.	8.5
43	211	Smith	128366.	55751.	434.	9.5
43	212	Somervell	4154.	3641.	876.	8.3
43	213	Starr	27266.	58701.	2152.	45.0
43	214	Stephens	9926.	10373.	1045.	10.7
43	215	Sterling	1206.	7415.	6148.	14.4
43	216	Stonewall	2406.	14202.	5902.	12.9
43	217	Sutton	5130.	15399.	3001.	15.8
43	218	Swisher	9723.	129964.	13366.	19.3
43	219	Tarrant	860880.	24978.	29.	6.9
43	220	Taylor	110932.	56527.	509.	8.6
43	221	Terrell	1595.	9405.	5896.	16.1
43	222	Terry	14581.	63676.	4367.	17.3
43	223	Throckmorton	2053.	14998.	7305.	14.5
43	224	Titus	21442.	21482.	1001.	8.8

Appendix B-1K

OFFICE OF TECHNOLOGY ASSESSMENT: STRUCTURE OF AGRICULTURE
Alphabetic (by state) of all counties in the four states

Texas

St	Cnt	Name	Pop.	Agvalue	Agpci	Poverty
43	225	Tom Green	84784.	38803.	457.	8.9
43	226	Travis	419573.	25266.	60.	8.9
43	227	Trinity	9450.	8956.	947.	15.2
43	228	Tyler	16223.	8541.	526.	12.7
43	229	Upshur	28595.	32473.	1135.	10.6
43	230	Upton	4619.	5177.	1120.	13.6
43	231	Uvalde	22441.	41722.	1859.	22.3
43	232	Val Verde	35910.	15634.	435.	24.3
43	233	Van Zandt	31426.	39295.	1250.	10.5
43	234	Victoria	68807.	28660.	416.	9.9
43	235	Walker	41789.	15529.	371.	13.1
43	236	Waller	19798.	37556.	1897.	13.3
43	237	Ward	13976.	2181.	156.	11.3
43	238	Washington	21998.	32565.	1434.	12.0
43	239	Webb	99258.	37248.	375.	29.0
43	240	Wharton	40242.	115385.	2867.	13.6
43	241	Wheeler	7137.	37203.	5212.	11.3
43	242	Wichita	121082.	18849.	155.	9.4
43	243	Wilbarger	15931.	36991.	2322.	14.2
43	244	Willacy	17495.	50897.	2909.	29.6
43	245	Williamson	76521.	54716.	715.	7.7
43	246	Wilson	16756.	45468.	2713.	15.6
43	247	Winkler	9944.	3047.	306.	10.0
43	248	Wise	26575.	43235.	1626.	9.3
43	249	Wood	24697.	35245.	1427.	10.6
43	250	Yoakum	8299.	28768.	3466.	12.7
43	251	Young	19083.	21944.	1149.	8.2
43	252	Zapata	6628.	14942.	2254.	23.8
43	253	Zavala	11666.	43134.	3697.	34.7

Appendix B-2

Counties with high agricultural influence

4021 PINAL, AZ
4027 YUMA, AZ
6007 BUTTE, CA
6011 COLUSA, CA
6019 FRESNO, CA
6021 GLENN, CA
6025 IMPERIAL, CA
6029 KERN, CA
6031 KINGS, CA
6039 MADERA, CA
6047 MERCED, CA
6049 MODOC, CA
6053 MONTEREY, CA
6069 SAN BENITO, CA
6077 SAN JOAQUIN, CA
6079 SAN LUIS OBISPO, CA
6099 STANISLAUS, CA
6101 SUTTER, CA
6107 TULARE, CA
6113 YOLO, CA
12027 DE SOTO, FL
12043 GLADES, FL
12049 HARDEE, FL
12051 HENDRY, FL
12067 LAFAYETTE, FL
12069 LAKE, FL
12093 OKEECHOBEE, FL
12099 PALM BEACH, FL
12105 POLK, FL
48017 BAILEY, TX
48023 BAYLOR, TX
48033 BORDEN, TX
48045 BRISCOE, TX
48065 CARSON, TX
48069 CASTRO, TX
48077 CLAY, TX
48079 COCHRAN, TX
48087 COLLINGSWORTH, TX
48089 COLORADO, TX
48093 COMANCHE, TX
48095 CONCHO, TX
48101 COTTLE, TX
48105 CROCKETT, TX
48107 CROSBY, TX
48111 DALLAM, TX
48115 DAWSON, TX
48125 DICKENS, TX
48127 DIMMIT, TX
48143 ERATH, TX
48151 FISHER, TX
48153 FLOYD, TX
48163 FRIO, TX
48165 GAINES, TX
48169 GARZA, TX
48173 GLASSCOCK, TX
48177 GONZALES, TX
48179 GRAY, TX
48189 HALE, TX
48191 HALL, TX
48197 HARDEMAN, TX
48207 HASKELL, TX
48211 HEMPHILL, TX
48215 HIDALGO, TX
48219 HOCKLEY, TX
48223 HOPKINS, TX
48229 HUDSPETH, TX
48239 JACKSON, TX
48243 JEFF DAVIS, TX
48261 KENEDY, TX
48263 KENT, TX
48267 KIMBLE, TX
48275 KNOX, TX
48279 LAMB, TX
48283 LA SALLE, TX
48295 LIPSCOMB, TX
48305 LYNN, TX
48311 MCMULLEN, TX
48317 MARTIN, TX
48335 MITCHELL, TX
48341 MOORE, TX
48345 MOTLEY, TX
48357 OCHILTREE, TX
48369 PARMER, TX
48371 PECOS, TX
48381 RANDALL, TX
48389 REEVES, TX
48399 RUNNELS, TX
48411 SAN SABA, TX
48419 SHELBY, TX
48431 STERLING, TX
48433 STONEWALL, TX
48437 SWISHER, TX
48441 TAYLOR, TX
48445 TERRY, TX
48487 WILBARGER, TX
48489 WILLACY, TX
48501 YOAKUM, TX
48507 ZAVALA, TX

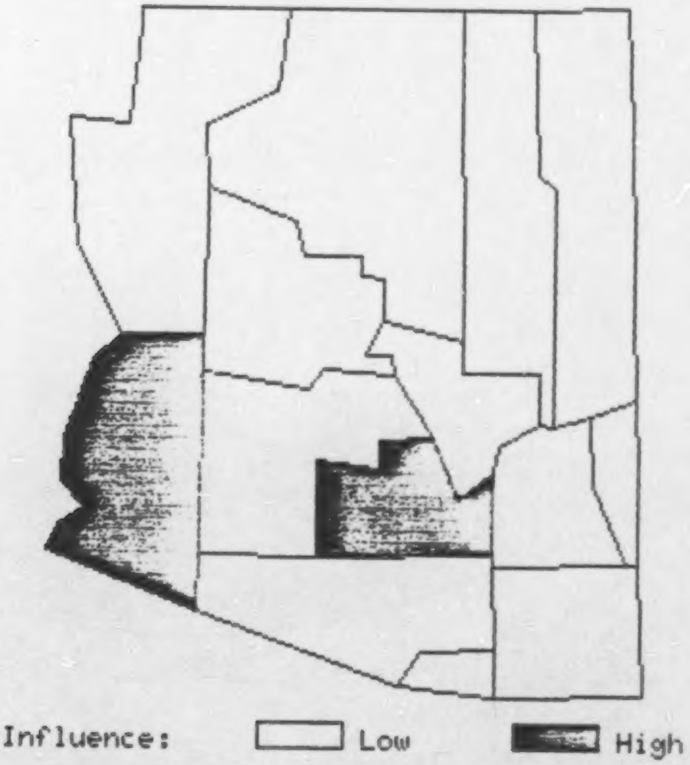
APPENDIX C

Poverty and Agribusiness Maps for the Study Area

MAP C-1

MAP C-1

Counties with High Agricultural Influence
– Arizona –


Influence:
Low
High

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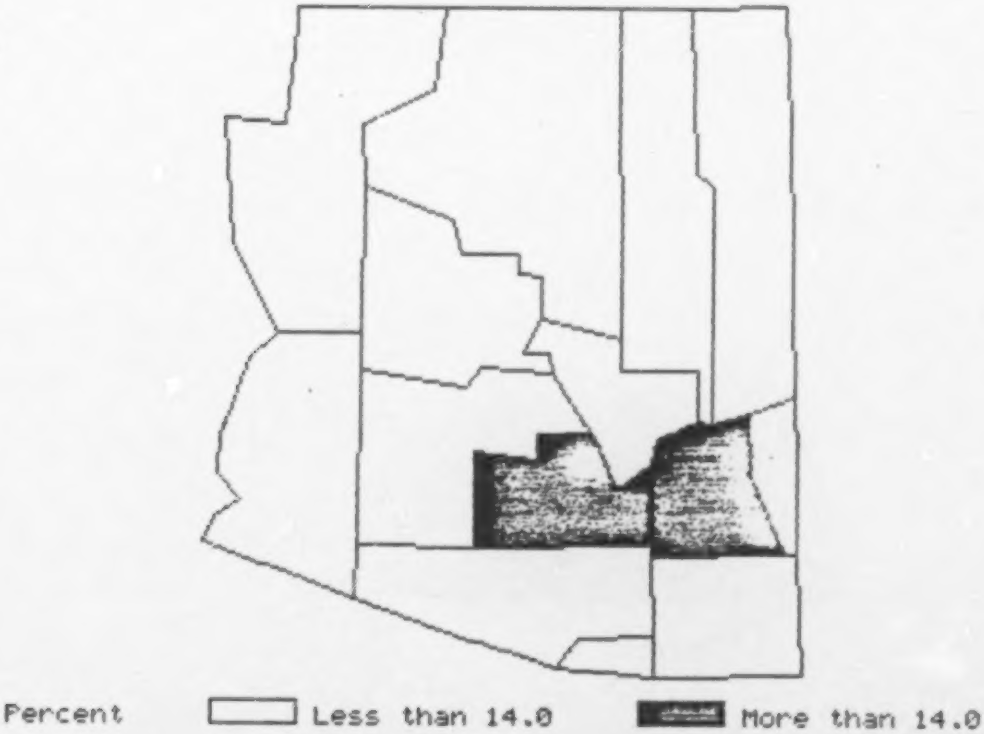
Counties with High Poverty Rates
- Arizona -


Percent
▭ Less than 14.0
▨ More than 14.0

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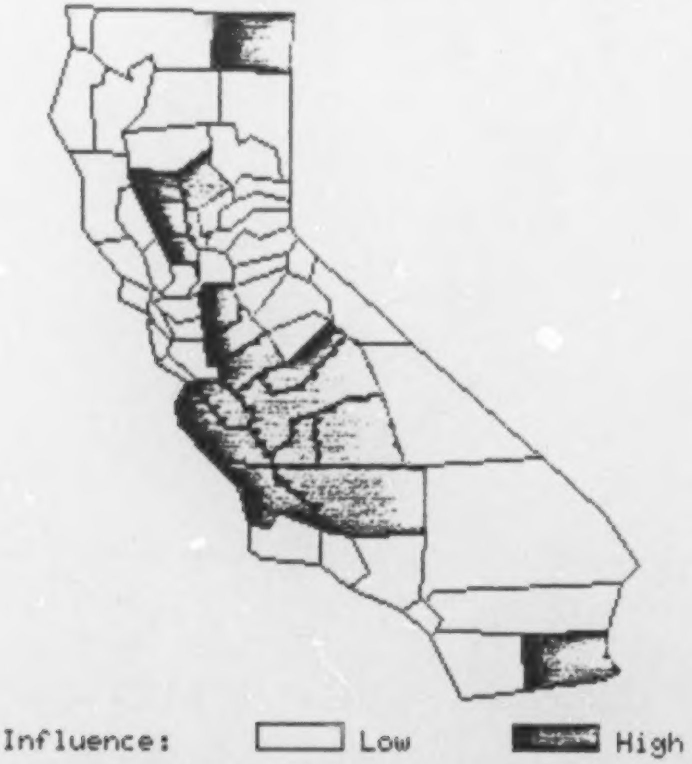
University of California, Davis

MAP C-3

MAP C-3

Counties with High Agricultural Influence
- California -


Influence:
Low
High

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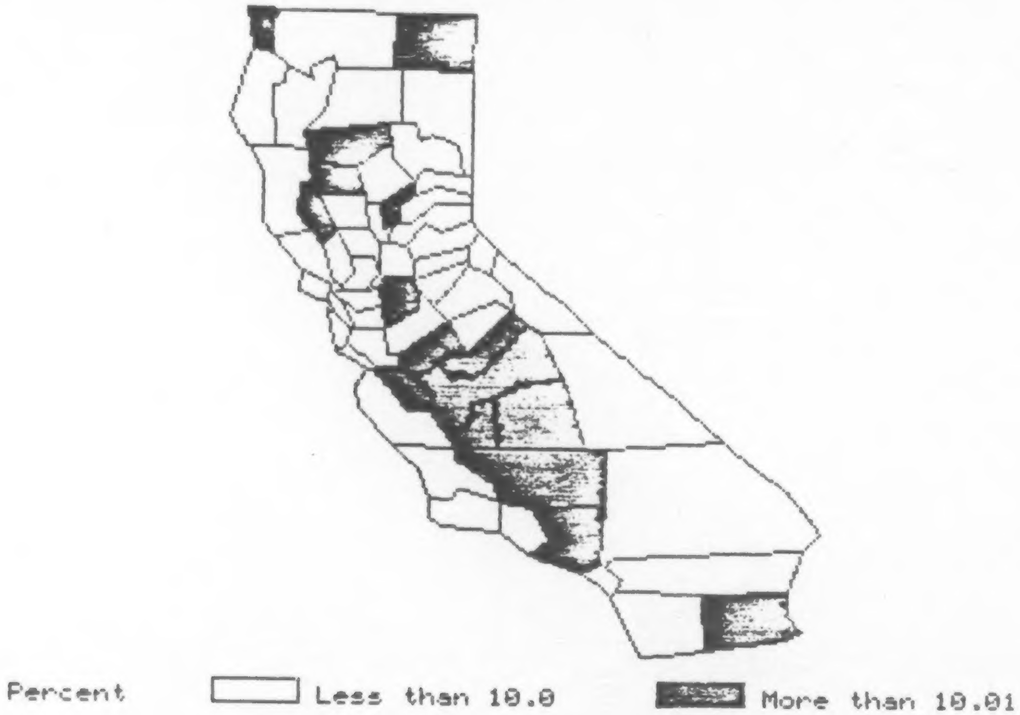
MAP C-4 MAP C-4

Counties with High Poverty Rates
- California -


Percent
☐ Less than 10.0
▨ More than 10.01

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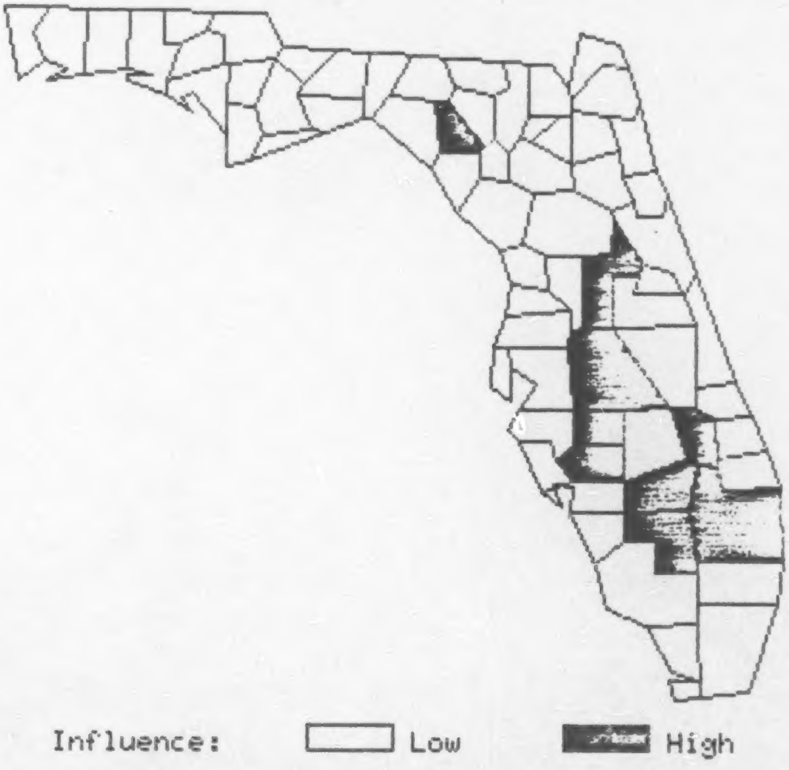
MAP C-5 MAP C-5

Counties with High Agricultural Influence
- Florida -


Influence:
▭ Low
■ High

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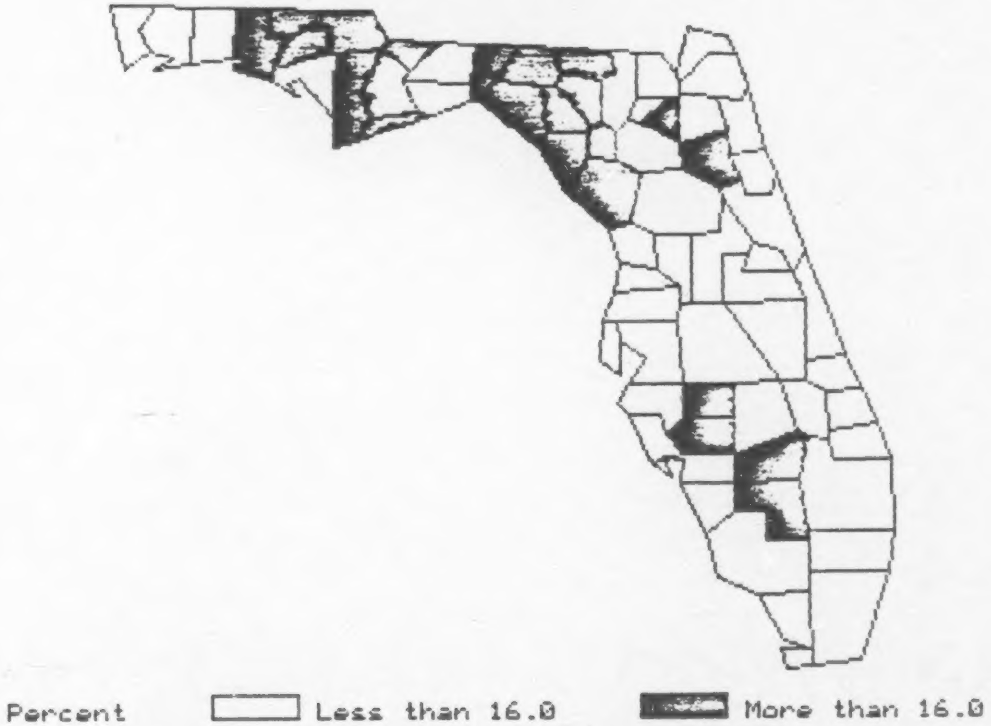
MAP C-6

MAP C-6

Counties with High Poverty Rates

– Florida –


Percent
☐ Less than 16.0
▨ More than 16.0

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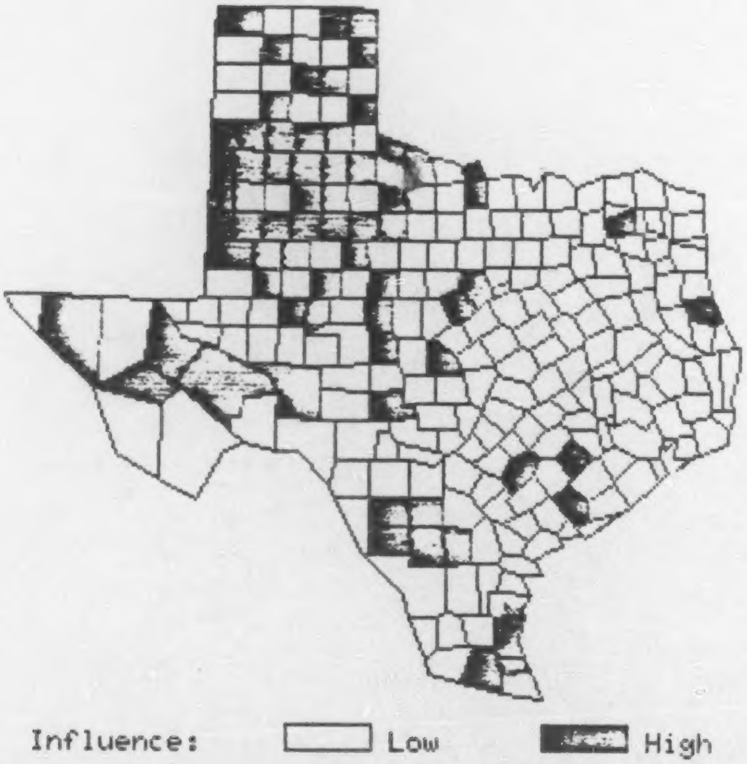
MAP C-7

MAP C-7

Counties with High Agricultural Influence

– *Texas* –


Influence:
Low
High

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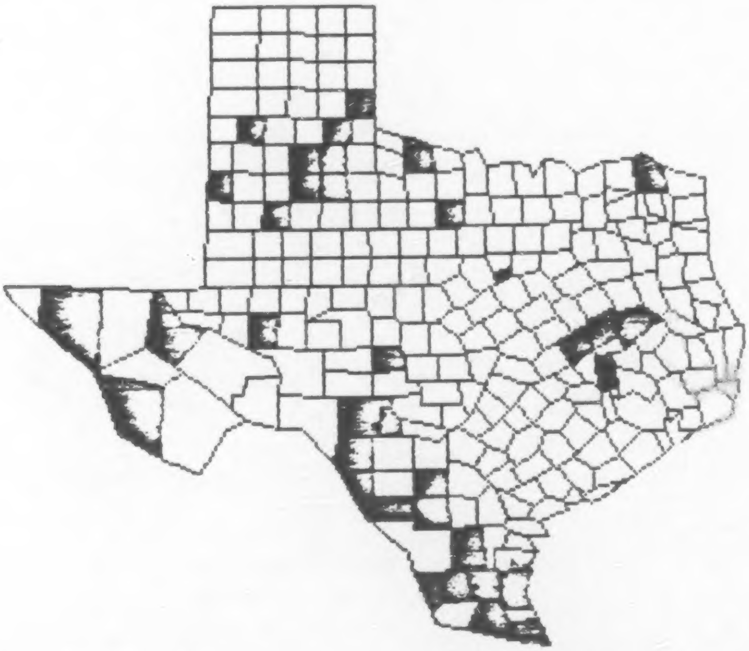
MAP C-8

MAP C-8

Counties with High Poverty Rates

— Texas —



Percent ▭ Less than 20.0 ■ More than 20.0

Macrosocial Accounting Project

University of California, Davis

APPENDIX D

Regression Equations for Agricultural Structure X Social Conditions

TABLE D-1

```
                                                  SAS                                    21:26 MONDAY, FEBRUARY 25, 1985   3
 DEP VARIABLE: NEWS      PERCENT URBAN POPULATION 1980
                                                ANALYSIS OF VARIANCE

                                             SUM OF          MEAN
                        SOURCE      DF      SQUARES        SQUARE        F VALUE        PROB>F

                        MODEL        2     15665.48      7832.741         10.574        0.0001
                        ERROR       93      68891.6      740.7699
                        C TOTAL     95     84557.06

                           ROOT MSE        27.21709      R-SQUARE         0.1853
                           DEP MEAN        46.29662      ADJ R-SQ         0.1677
                           C.V.            58.78851

                                                PARAMETER ESTIMATES


                             PARAMETER        STANDARD    T FOR H0:                     STANDARDIZED
            VARIABLE  DF      ESTIMATE           ERROR  PARAMETER=0    PROB > |T|          ESTIMATE      TOLERANCE

            INTERCEP   1      44.40223        3.590505       12.367        0.0001                 0              .
            V10        1   -0.00150725  0.0007173309       -2.101        0.0383         -0.199259      0.9741552
            V1208      1    0.00315346  0.0008523916        3.700        0.0004         0.3508332      0.9741552


                          VARIABLE
            VARIABLE  DF     LABEL

            INTERCEP   1   INTERCEPT
            V10        1   1978 AVE SIZE OF FARMS (ACRES)
            V1208      1   1978 NO. HIRED WORKERS, 150 DAYS OR MORE
```

TABLE D-1

TABLE D-2

```
                                            SAS                             21:26 MONDAY, FEBRUARY 25, 1985   4

DEP VARIABLE: PRRLPOP8 Rural Population as % of Total Pop: 1980
                                                 ANALYSIS OF VARIANCE

                                               SUM OF          MEAN
                         SOURCE      DF       SQUARES        SQUARE       F VALUE        PROB>F

                         MODEL        2      1.566548     0.7832741        10.574        0.0001
                         ERROR       93       6.88916    0.07407699
                         C TOTAL     95      8.455708

                              ROOT MSE      0.2721709      R-SQUARE        0.1853
                              DEP MEAN      0.5370338      ADJ R-SQ        0.1677
                              C.V.            50.6804

                                                 PARAMETER ESTIMATES

                     PARAMETER        STANDARD     T FOR H0:                    STANDARDIZED
 VARIABLE   DF        ESTIMATE           ERROR   PARAMETER=0     PROB > |T|         ESTIMATE       TOLERANCE

 INTERCEP    1       0.5559777      0.03590305        15.486         0.0001                0               .
 V10         1  .00001507252   .00000717331          2.101         0.0383        0.1992594       0.9741552
 V1208       1  -.0000315346   .00000852392         -3.700         0.0004        -0.350833       0.9741552

                  VARIABLE
 VARIABLE   DF      LABEL

 INTERCEP    1  INTERCEPT
 V10         1  1978 AVE SIZE OF FARMS (ACRES)
 V1208       1  1978 NO. HIRED WORKERS, 150 DAYS OR MORE
```

TABLE D-2

TABLE D-3

```
                                         SAS                                  21:26 MONDAY, FEBRUARY 25, 1985 16
 DEP VARIABLE: PFRMPOP8 Farm Population as % of Total Pop: 1980
                                              ANALYSIS OF VARIANCE

                                               SUM OF          MEAN
                          SOURCE     DF       SQUARES        SQUARE        F VALUE        PROB>F

                          MODEL       1     0.1554859     0.1554859         27.386        0.0001
                          ERROR      94     0.5336837   0.005677486
                          C TOTAL    95     0.6891696

                             ROOT MSE     0.07534909      R-SQUARE          0.2256
                             DEP MEAN      0.1074828      ADJ R-SQ          0.2174
                             C.V.           70.10342

                                              PARAMETER ESTIMATES


                             PARAMETER        STANDARD     T FOR H0:                        STANDARDIZED
          VARIABLE   DF       ESTIMATE           ERROR   PARAMETER=0     PROB > |T|           ESTIMATE      TOLERANCE

          INTERCEP    1      0.1472296      0.01080864        13.621         0.0001                  0              .
          V751P       1    -0.00873475     0.001669103        -5.233         0.0001          -0.474988              1


                         VARIABLE
          VARIABLE   DF     LABEL

          INTERCEP    1  INTERCEPT
          V751P       1  % of farms corporately owned: 1980
```

TABLE D-3

TABLE D-4

```
                                                           SAS                                         21:26 MONDAY, FEBRUARY 25, 1985 17

  DEP VARIABLE: RANCHET8 Non-Farm pop as % of rural Pop: 1980
                                                   ANALYSIS OF VARIANCE

                                         SUM OF           MEAN
                   SOURCE      DF       SQUARES         SQUARE       F VALUE       PROB>F

                   MODEL        2       4701.28        2350.64        27.023       0.0001
                   ERROR       93      8089.644       86.98542
                   C TOTAL     95      12790.92

                       ROOT MSE        9.326598       R-SQUARE        0.3675
                       DEP MEAN        79.93025       ADJ R-SQ        0.3539
                       C.V.            11.66842

                                                   PARAMETER ESTIMATES

                        PARAMETER        STANDARD     T FOR H0:                    STANDARDIZED
   VARIABLE  DF          ESTIMATE           ERROR   PARAMETER=0    PROB > |T|          ESTIMATE       TOLERANCE

   INTERCEP   1          78.73689        2.078667        37.879        0.0001                 0               .
   V751P      1          1.699475       0.2312140         7.350        0.0001         0.6783376       0.7984091
   V1069      1    -0.000127158   .00004011687        -3.170        0.0021         -0.292534       0.7984091

                     VARIABLE
   VARIABLE  DF        LABEL

   INTERCEP   1   INTERCEPT
   V751P      1   % of farms corporately owned: 1980
   V1069      1   1978 AVE VALUE MACHINES, EQUIP/FARM ($)
```

TABLE D-4

TABLE D-5

```
BMDP1R Page   7

 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 20:58:57


 REGRESSION TITLE IS                     TOTAL POPULATION: PROPORTIONAL CHANGE FROM  1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . . .     21 XPOPULAT
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R             0.6704           STD. ERROR OF EST.          0.1621
 MULTIPLE R-SQUARE      0.4494

 ANALYSIS OF VARIANCE
                      SUM OF SQUARES     DF     MEAN SQUARE       F RATIO    P(TAIL)
          REGRESSION          1.9949      4          0.4987        18.976     0.0000
          RESIDUAL            2.4442     93          0.0263

                                               STD. REG
    VARIABLE        COEFFICIENT   STD. ERROR     COEFF          T    P(2 TAIL) TOLERANCE    VARIABLE LABEL...

 INTERCEPT               0.15348
 E2031P      3           0.04601     0.00673      0.762     6.837     0.0000      0.47699 1970: Percent farms: corporate ownership
 D6003       4      -0.68593E-05 0.22728E-05     -0.310    -3.018     0.0033      0.56261 1970: Average value of equipment per farm
 D1003       5      -0.12113E-04 0.39726E-05     -0.247    -3.049     0.0030      0.90568 1970: Average farm size (acres)
 CCDB0016   22       0.33351E-06 0.23050E-06      0.125     1.447     0.1513      0.79408 1970: Total population

 Number of integer words of storage used in preceding    problem 7068
 Elapsed time:       0.07 minutes.
```

TABLE D-5

TABLE D-6

```
BMDP1R Page  10

 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 20:59:09

 REGRESSION TITLE IS                    RURAL POPULATION: PROPORTIONAL CHANGE  FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . . .        30 XRURLPOP
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R             0.5605          STD. ERROR OF EST.          0.2173
 MULTIPLE R-SQUARE      0.3141

 ANALYSIS OF VARIANCE
                    SUM OF SQUARES      DF     MEAN SQUARE        F RATIO     P(TAIL)
          REGRESSION        2.0105       4          0.5026        10.647      0.0000
          RESIDUAL          4.3902      93          0.0472

                                                  STD. REG
    VARIABLE          COEFFICIENT   STD. ERROR      COEFF          T    P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT                0.19387
 E2031P      3            0.05603      0.00879         0.772     6.375     0.0000      0.50246 1970: Percent farms: Corporate ownership
 D6003       4     -0.13282E-04 0.30576E-05           -0.499    -4.344     0.0000      0.55840 1970: Average value of equipment per farm
 D1003       5     -0.13051E-04 0.53267E-05           -0.221    -2.450     0.0162      0.90483 1970: Average farm size (acres)
 NEW2       31     -0.12220E-05 0.11491E-05           -0.098    -1.064     0.2903      0.87239 1970: Total rural population

 Number of integer words of storage used in preceding    problem 7068
 Elapsed time:      0.07 minutes.
```

TABLE D-6

TABLE D-7

```
BMDP1R Page  16


 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 21:01:31


 REGRESSION TITLE IS                    FARM POPULATION: PROPORTIONAL CHANGE  FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . . .      48 XFARMPOP
   TOLERANCE . . . . . . . . . . . . . . . . . . . . .  0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R             0.3799          STD. ERROR OF EST.         0.2670
 MULTIPLE R-SQUARE      0.1443

 ANALYSIS OF VARIANCE
                       SUM OF SQUARES      DF     MEAN SQUARE       F RATIO    P(TAIL)
          REGRESSION           1.1427       2          0.5713         8.012     0.0006
          RESIDUAL             6.7743      95          0.0713

                                                  STD. REG
    VARIABLE        COEFFICIENT  STD. ERROR         COEFF        T    P(2 TAIL) TOLERANCE    VARIABLE LABEL...

 INTERCEPT               -0.30676
 D5045F       9           0.01227     0.00333         0.351      3.686    0.0004     0.99326 1970: Per farm expenditures: hired labor
 CCDB0045    49     0.10019E-04 0.79976E-05         0.119      1.253    0.2134     0.99326 1970: Farm population

 Number of integer words of storage used in preceding    problem 6836
 Elapsed time:      0.06 minutes.
```

TABLE D-7

TABLE D-8

```
BMDP1R Page   8


 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 20:59:01

 REGRESSION TITLE IS                    TOTAL HOUSING UNITS: PROPORTIONAL CHANGE  FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .      24 XHOSUNIT
   TOLERANCE . . . . . . . . . . . . . . . . . . . .  0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R             0.7389            STD. ERROR OF EST.          0.1960
 MULTIPLE R-SQUARE      0.5460

 ANALYSIS OF VARIANCE
                     SUM OF SQUARES     DF     MEAN SQUARE       F RATIO     P(TAIL)
          REGRESSION          4.2991      4          1.0748       27.964      0.0000
          RESIDUAL            3.5744     93          0.0384

                                                  STD. REG
    VARIABLE         COEFFICIENT   STD. ERROR       COEFF          T    P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT              0.24501
 E2031P       3         0.06553      0.00826        0.815      7.931     0.0000      0.46283 1970: Percent farms: Corporate ownership
 D6003        4    -0.90637E-05 0.27499E-05        -0.307     -3.296     0.0014      0.56205 1970: Average value of equipment per farm
 D1003        5    -0.15594E-04 0.48201E-05        -0.238     -3.235     0.0017      0.89969 1970: Average farm size (acres)
 CCDB0286    25     0.16732E-05 0.84363E-06         0.159      1.983     0.0503      0.76382 1970: Total year-round housing units

 Number of integer words of storage used in preceding    problem 7068
 Elapsed time:      0.07 minutes.
```

TABLE D-8

TABLE D-9

```
BMDP1R Page   6


 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 20:58:53


 REGRESSION TITLE IS                     PRE-1940 HOUSING UNITS: PROPORTIONAL  CHANGE FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .        18 XPOLDHOS
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R              0.6395          STD. ERROR OF EST.         0.1381
 MULTIPLE R-SQUARE       0.4090

 ANALYSIS OF VARIANCE
                       SUM OF SQUARES      DF     MEAN SQUARE       F RATIO    P(TAIL)
         REGRESSION            1.2148       5          0.2430        12.733     0.0000
         RESIDUAL              1.7555      92          0.0191

                                                   STD. REG
   VARIABLE        COEFFICIENT   STD. ERROR         COEFF           T    P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT              -0.16222
 E2031P      3          -0.03162      0.00567        -0.640     -5.575      0.0000      0.48759 1970: Percent farms: corporate ownership
 D6003       4      0.47693E-05 0.20353E-05         0.263      2.343      0.0213      0.50939 1970: Average value of equipment per farm
 D1003       5      0.80187E-05 0.34163E-05         0.200      2.347      0.0211      0.88918 1970: Average farm size (acres)
 E15002      8     -0.20673E-04 0.88026E-05        -0.222     -2.349      0.0210      0.71992 1970: Number of full-time hired workers
 NEW14      19      0.26049E-03 0.14468E-02         0.016      0.180      0.8575      0.78214 1970: Pre-1940 housing units as % of total

 Number of integer words of storage used in preceding    problem 7068
 Elapsed time:      0.07 minutes.
```

TABLE D-9

TABLE D-10

```
                                                              SAS                                         21:26 MONDAY, FEBRUARY 25, 1985  5
DEP VARIABLE: MONY7901 MEDIAN FAMILY INCOME 1979
                                                      ANALYSIS OF VARIANCE

                                             SUM OF          MEAN
                         SOURCE      DF     SQUARES        SQUARE        F VALUE        PROB>F

                         MODEL        2    90282105      45141053          6.740        0.0018
                         ERROR       93   622901880       6697870
                         C TOTAL     95   713183985

                             ROOT MSE      2588.024      R-SQUARE         0.1266
                             DEP MEAN      15817.43      ADJ R-SQ         0.1078
                             C.V.          16.36185

                                                      PARAMETER ESTIMATES

                             PARAMETER        STANDARD      T FOR H0:                     STANDARDIZED
        VARIABLE  DF          ESTIMATE           ERROR    PARAMETER=0     PROB > |T|          ESTIMATE      TOLERANCE

        INTERCEP   1          15737.63        341.3956         46.098         0.0001                 0              .
        V10        1         -0.132168      0.06820971         -1.938         0.0557         -0.190255      0.9741552
        V1208      1         0.2242205       0.0810524          2.766         0.0068         0.2716208      0.9741552


                        VARIABLE
        VARIABLE  DF      LABEL

        INTERCEP   1    INTERCEPT
        V10        1    1978 AVE SIZE OF FARMS (ACRES)
        V1208      1    1978 NO. HIRED WORKERS, 150 DAYS OR MORE
```

TABLE D-10

TABLE D-11

```
BMDP1R Page  15

 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 21:01:28

 REGRESSION TITLE IS                     MEDIAN FAMILY INCOME: PROPORTIONAL CHANGE  FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .        45 XMDINCOM
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R              0.5628           STD. ERROR OF EST.          0.5250
 MULTIPLE R-SQUARE       0.3168

 ANALYSIS OF VARIANCE
                      SUM OF SQUARES     DF    MEAN SQUARE       F RATIO    P(TAIL)
          REGRESSION        12.1405       2         6.0703        22.022     0.0000
          RESIDUAL          26.1863      95         0.2756

                                                 STD. REG
    VARIABLE       COEFFICIENT  STD. ERROR        COEFF          T    P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT              5.71260
 MOD3001P    6         -0.01496     0.00490        -0.282     -3.053     0.0029      0.84559 1970: Percent farms: $40k plus sales
 CCDB0244   46     -0.17102E-03 0.40536E-04        -0.389     -4.219     0.0001      0.84559 1970: Median family income

 Number of integer words of storage used in preceding    problem 6836
 Elapsed time:       0.06 minutes.
```

TABLE D-11

```
        TABLE D-12                                   SAS                          21:26 MONDAY, FEBRUARY 25, 1985  9

DEP VARIABLE: NEW7     PERCENT UNEMPLOYED 1980
                                                  ANALYSIS OF VARIANCE

                                          SUM OF          MEAN
                     SOURCE     DF       SQUARES        SQUARE       F VALUE         PROB>F

                     MODEL       4      312.4484       78.1121        11.589         0.0001
                     ERROR      91        613.37       6.74033
                     C TOTAL    95      925.8184

                        ROOT MSE        2.596214      R-SQUARE        0.3375
                        DEP MEAN        4.706846      ADJ R-SQ        0.3084
                        C.V.            55.15826

                                                  PARAMETER ESTIMATES

                              PARAMETER        STANDARD     T FOR H0:                     STANDARDIZED
          VARIABLE  DF         ESTIMATE           ERROR   PARAMETER=0     PROB > |T|          ESTIMATE        TOLERANCE

          INTERCEP   1         4.186181       0.6284856         6.661         0.0001                 0                .
          V10        1     -0.000259542    0.0000799102        -3.248         0.0016         -0.327909         0.714267
          V1208      1     0.0003644622     0.000088926         4.098         0.0001         0.3875057         0.814417
          V297P      1        0.1381821      0.04501746         3.070         0.0028         0.4827661        0.2943226
          V1069      1     -.0000406023    .00001804226        -2.250         0.0268         -0.347193        0.3058669

                            VARIABLE
          VARIABLE  DF        LABEL

          INTERCEP   1     INTERCEPT
          V10        1     1978 AVE SIZE OF FARMS (ACRES)
          V1208      1     1978 NO. HIRED WORKERS, 150 DAYS OR MORE
          V297P      1     % of farms w/$100K in annual sales: 1980
          V1069      1     1978 AVE VALUE MACHINES, EQUIP/FARM ($)
```

TABLE D-12

```
        TABLE D-13                              SAS                          21:26 MONDAY, FEBRUARY 25, 1985  6

DEP VARIABLE: NEW6     PCT. FAMILIES BELOW POVERTY 1980
                                                  ANALYSIS OF VARIANCE

                                         SUM OF          MEAN
                       SOURCE     DF    SQUARES        SQUARE       F VALUE       PROB>F

                       MODEL       2   424.4869      212.2435         6.573       0.0021
                       ERROR      93   3002.922      32.28949
                       C TOTAL    95   3427.409

                           ROOT MSE    5.682384      R-SQUARE        0.1239
                           DEP MEAN    14.86446      ADJ R-SQ        0.1050
                           C.V.          38.228

                                                  PARAMETER ESTIMATES

                         PARAMETER        STANDARD    T FOR H0:                    STANDARDIZED
VARIABLE  DF              ESTIMATE           ERROR  PARAMETER=0    PROB > |T|          ESTIMATE       TOLERANCE

INTERCEP   1              14.64889       0.7495838       19.543        0.0001                 0               .
V10        1          0.0003827215    0.0001497643        2.555        0.0122         0.2513089       0.9741552
V1208      1          -0.000378673    0.0001779623       -2.128        0.0360         -0.209252       0.9741552

               VARIABLE
VARIABLE  DF     LABEL

INTERCEP   1   INTERCEPT
V10        1   1978 AVE SIZE OF FARMS (ACRES)
V1208      1   1978 NO. HIRED WORKERS, 150 DAYS OR MORE
```

TABLE D-13

D-12

TABLE D-14

```
                                                          SAS                                    21:26 MONDAY, FEBRUARY 25, 1985  7
DEP VARIABLE: POVIND80 Unrelated Individuals in poverty: 1980
                                                  ANALYSIS OF VARIANCE

                                              SUM OF           MEAN
                         SOURCE     DF       SQUARES         SQUARE       F VALUE        PROB>F

                         MODEL       2       537.664        268.832         8.569        0.0004
                         ERROR      93      2917.796       31.37415
                         C TOTAL    95       3455.46

                            ROOT MSE        5.601263       R-SQUARE        0.1556
                            DEP MEAN        14.65104       ADJ R-SQ        0.1374
                            C.V.            38.23116

                                                  PARAMETER ESTIMATES

                      PARAMETER       STANDARD     T FOR H0:                   STANDARDIZED
VARIABLE  DF           ESTIMATE          ERROR   PARAMETER=0    PROB > |T|         ESTIMATE       TOLERANCE

INTERCEP   1            15.0952      0.6375829        18.022        0.0001                0               .
V10        1    0.0005128827    0.0001474362           3.479        0.0008        0.3354078        0.976669
V751P      1          -0.345152      0.1255502        -2.749        0.0072       -0.265065        0.976669

               VARIABLE
VARIABLE  DF      LABEL

INTERCEP   1   INTERCEPT
V10        1   1978 AVE SIZE OF FARMS (ACRES)
V751P      1   % of farms corporately owned: 1980
```

TABLE D-14

TABLE D-15

```
BMDP1R Page  23




 REGRESSION TITLE IS                    INDIVIDUAL POVERTY: PROPORTIONAL CHANGE  FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . .       36 POVIND78
   TOLERANCE . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R             0.6962         STD. ERROR OF EST.       128.7583
 MULTIPLE R-SQUARE      0.4846

 ANALYSIS OF VARIANCE
                      SUM OF SQUARES      DF     MEAN SQUARE       F RATIO    P(TAIL)
          REGRESSION    1309624.0000       2     654812.0000        39.497     0.0000
          RESIDUAL      1392610.1250      84      16578.6914

                                                    STD. REG
    VARIABLE        COEFFICIENT   STD. ERROR         COEFF          T   P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT            605.14557
 E15002      8        -0.02180      0.00735         -0.238     -2.967     0.0039     0.95123 1970: Number of full-time hired workers
 POVIND70   37       -21.09563      2.39006         -0.709     -8.826     0.0000     0.95123 1970: % of individuals below poverty line

 Number of integer words of storage used in preceding    problem 4480
 Elapsed time:      1.51 minutes.
```

TABLE D-15

TABLE D-16

```
REGRESSION TITLE IS                    FAMILY POVERTY: PROPORTIONAL CHANGE FROM 1970-1980...

  DEPENDENT VARIABLE. . . . . . . . . . . . . . . . .        12 XPFAMPOV
  TOLERANCE . . . . . . . . . . . . . . . . . . . . . . 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R            0.5021          STD. ERROR OF EST.         0.1654
MULTIPLE R-SQUARE     0.2522

ANALYSIS OF VARIANCE
                      SUM OF SQUARES     DF     MEAN SQUARE       F RATIO     P(TAIL)
         REGRESSION          0.8674       3          0.2891        10.565      0.0000
         RESIDUAL            2.5726      94          0.0274

                                                STD. REG
   VARIABLE        COEFFICIENT   STD. ERROR       COEFF          T    P(2 TAIL) TOLERANCE   VARIABLE LABEL...

INTERCEPT              -0.18577
D6003        4     0.11130E-04 0.28791E-05         0.571      3.866     0.0002       0.36566 1970: Average value of equipment per farm
MOD5047F     7        -0.01647     0.00587        -0.408     -2.805     0.0061       0.37566 1970: Per farm expenditures: contract labor
CCDB0249    13        -0.00652     0.00202        -0.298     -3.237     0.0017       0.93924 1970: Percent families below poverty line

Number of integer words of storage used in preceding    problem 7068
Elapsed time:      2.15 minutes.
```

TABLE D-16

```
        TABLE D-17                                   SAS                               21:26 MONDAY, FEBRUARY 25, 1985 10

DEP VARIABLE: GOVT7704 TOTAL LOCAL GOVT TAXES ($1000) 1977
                                                ANALYSIS OF VARIANCE

                                        SUM OF          MEAN
                    SOURCE     DF      SQUARES        SQUARE       F VALUE       PROB>F

                    MODEL       2 143340922350   71670461175       310.836       0.0001
                    ERROR      93  21443296569     230573081
                    C TOTAL    95 164784218918

                       ROOT MSE       15184.63      R-SQUARE        0.8699
                       DEP MEAN       18481.07      ADJ R-SQ        0.8671
                       C.V.           82.16316

                                               PARAMETER ESTIMATES

                        PARAMETER      STANDARD     T FOR HO:                 STANDARDIZED
VARIABLE  DF             ESTIMATE         ERROR   PARAMETER=0   PROB > |T|        ESTIMATE     TOLERANCE

INTERCEP   1             2676.573      2083.126         1.285       0.2020               0             .
V1208      1             12.56815     0.5702139        22.041       0.0001        1.001618     0.6775732
V876F      1             -966.876      331.0163        -2.921       0.0044       -0.132736     0.6775732

                       VARIABLE
VARIABLE  DF              LABEL

INTERCEP   1   INTERCEPT
V1208      1   1978 NO. HIRED WORKERS, 150 DAYS OR MORE
V876F      1   Per Farm expend on Fertilizer: 1980
```

TABLE D-17

TABLE D-18

```
                                                   SAS                                    21:26 MONDAY, FEBRUARY 25, 1985 11

DEP VARIABLE: GOVT7709 LOCAL GOVT EXPENDS PER CAPITA 1977
                                           ANALYSIS OF VARIANCE

                                           SUM OF          MEAN
                        SOURCE     DF     SQUARES        SQUARE        F VALUE       PROB>F

                        MODEL       1    762933.6      762933.6          8.139       0.0053
                        ERROR      94     8611212       93736.3
                        C TOTAL    95     9574146

                            ROOT MSE     306.1638      R-SQUARE         0.0797
                            DEP MEAN     774.5208      ADJ R-SQ         0.0699
                            C.V.         39.52945

                                           PARAMETER ESTIMATES

                          PARAMETER        STANDARD    T FOR H0:                   STANDARDIZED
VARIABLE   DF              ESTIMATE           ERROR  PARAMETER=0    PROB > |T|         ESTIMATE      TOLERANCE

INTERCEP    1              729.9588         34.9342       20.895        0.0001                0              .
V1208       1            0.02699945     0.009463799        2.853        0.0053        0.2822886              1

                     VARIABLE
VARIABLE   DF          LABEL

INTERCEP    1    INTERCEPT
V1208       1    1978 NO. HIRED WORKERS, 150 DAYS OR MORE
```

TABLE D-18

TABLE D-19

```
BMDP1R Page   5

 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 20:58:49

 REGRESSION TITLE IS                   TOTAL GOVERNMENT REVENUES: PROPORTIONAL  CHANGE FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .      15 XGOVTREV
   TOLERANCE . . . . . . . . . . . . . . . . . . . .  0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R             0.4590           STD. ERROR OF EST.     85125.6328
 MULTIPLE R-SQUARE      0.2106

 ANALYSIS OF VARIANCE
                  SUM OF SQUARES      DF    MEAN SQUARE        F RATIO    P(TAIL)
         REGRESSION****************       3****************       8.361     0.0001
         RESIDUAL 681159032832.0000     947246372864.0000

                                                STD. REG
    VARIABLE        COEFFICIENT  STD. ERROR       COEFF         T   P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT         302440.46875
 E2031P       3     16570.51758  3321.63135         0.622     4.989    0.0000      0.53997 1970: Percent of farms: corporate ownership
 D6003        4        -3.68695     1.19030        -0.377    -3.097    0.0026      0.56559 1970: Average value of equipment per farm
 CCDB0388    16      -177.13387   259.80103        -0.066    -0.682    0.4970      0.90670 1970: Local government revenue: total

 Number of integer words of storage used in preceding    problem 7068
 Elapsed time:      0.06 minutes.
```

TABLE D-19

TABLE D-20

```
BMDP1R Page  14




REGRESSION TITLE IS                       PROPERTY TAX: PROPORTIONAL CHANGE  FROM 1970-1980...

  DEPENDENT VARIABLE. . . . . . . . . . . . . . . .       42 XPROPTAX
  TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
ALL DATA CONSIDERED AS A SINGLE GROUP

MULTIPLE R             0.3524           STD. ERROR OF EST.         1.6638
MULTIPLE R-SQUARE      0.1242

ANALYSIS OF VARIANCE
                      SUM OF SQUARES     DF    MEAN SQUARE       F RATIO    P(TAIL)
         REGRESSION       36.8848         3        12.2949         4.442     0.0058
         RESIDUAL        260.2051        94         2.7681

                                                  STD. REG
   VARIABLE        COEFFICIENT   STD. ERROR        COEFF         T    P(2 TAIL) TOLERANCE   VARIABLE LABEL...

INTERCEPT               4.60659
D1003          5    0.86975E-04 0.40252E-04        0.216      2.161     0.0333     0.92918 1970: Average farm size (acres)
E15002         8   -0.23338E-03 0.93021E-04       -0.250     -2.509     0.0138     0.93524 1970: Number of full-time hired workers
CCDB0399      43    0.35073E-03 0.22663E-02        0.016      0.155     0.8773     0.91355 1970: Property tax per capita

Number of integer words of storage used in preceding    problem 6836
Elapsed time:      2.12 minutes.
```

TABLE D-20

D15

```
TABLE D-21                          SAS                    21:26 MONDAY, FEBRUARY 25, 1985 13

DEP VARIABLE: RTLSALE8 Retail sales per 1000 Persons: 1980
                                    ANALYSIS OF VARIANCE

                                 SUM OF         MEAN
              SOURCE     DF     SQUARES       SQUARE       F VALUE       PROB>F

              MODEL       5    10115187      2023037        85.943       0.0001
              ERROR      90     2118531     23539.23
              C TOTAL    95    12233718

                 ROOT MSE       153.425     R-SQUARE        0.8268
                 DEP MEAN      168.8594     ADJ R-SQ        0.8172
                 C.V.          90.85962

                                    PARAMETER ESTIMATES

                        PARAMETER       STANDARD     T FOR H0:                  STANDARDIZED
     VARIABLE  DF        ESTIMATE          ERROR  PARAMETER=0    PROB > |T|        ESTIMATE     TOLERANCE

     INTERCEP   1        55.57176       33.14654        1.677        0.0971               0             .
     V1208      1       0.1037574    0.007908685       13.119        0.0001       0.9596837     0.3595894
     V751P      1        15.80906       6.107101        2.589        0.0112        0.204043     0.3096936
     V892F      1        -6.01463       2.100437       -2.864        0.0052       -0.314066     0.1599522
     V297P      1        -5.02268        1.85083       -2.714        0.0080       -0.152653     0.6080838
     V900F      1        12.37264       6.357296        1.946        0.0547       0.1735298     0.2420277

                    VARIABLE
     VARIABLE  DF     LABEL

     INTERCEP   1   INTERCEPT
     V1208      1   1978 NO. HIRED WORKERS, 150 DAYS OR MORE
     V751P      1   % of farms corporately owned: 1980
     V892F      1   Per Farm expend on Hired Labor: 1980
     V297P      1   % of farms w/$100K in annual sales: 1980
     V900F      1   Per Farm expend on Contract Labor: 1980
```

TABLE D-21

D20

TABLE D-22

```
                                              SAS                                      21:26 MONDAY, FEBRUARY 25, 1985 12

DEP VARIABLE: RTLSTOR8 Retail est. per 1000 Persons: 1980
                                        ANALYSIS OF VARIANCE

                                      SUM OF          MEAN
                    SOURCE     DF    SQUARES        SQUARE       F VALUE       PROB>F

                    MODEL       2    58.5831      29.29155       163.710       0.0001
                    ERROR      93   16.63989     0.1789236
                    C TOTAL    95   75.22299

                       ROOT MSE    0.4229936      R-SQUARE        0.7788
                       DEP MEAN    0.4728229      ADJ R-SQ        0.7740
                       C.V.         89.46131

                                        PARAMETER ESTIMATES

                      PARAMETER      STANDARD     T FOR H0:                   STANDARDIZED
VARIABLE   DF          ESTIMATE         ERROR   PARAMETER=0     PROB > |T|        ESTIMATE      TOLERANCE

INTERCEP    1          0.271322    0.08607435         3.152         0.0022               0              .
V1208       1      0.0002475106  .00001405292        17.613         0.0001       0.9232236      0.8656802
V297P       1        -0.0110984   0.004276685        -2.595         0.0110        -0.13603      0.8656802

                   VARIABLE
VARIABLE   DF        LABEL

INTERCEP    1    INTERCEPT
V1208       1    1978 NO. HIRED WORKERS, 150 DAYS OR MORE
V297P       1    % of farms w/$100K in annual sales: 1980
```

TABLE D-22

TABLE D-23

```
BMDP1R Page  11

 BMDP1R - MULTIPLE LINEAR REGRESSION
 Licensed Site: (4-534) UC Davis - Division of Environmental Studies
 License Expires: June 1985
 Date of run:  07-APR-85 at 20:59:13

 REGRESSION TITLE IS                            RETAIL ESTABLISHMENTS: PROPORTIONAL CHANGE  FROM 1970-1980...

   DEPENDENT VARIABLE. . . . . . . . . . . . . . . .      33 XRTLSTOR
   TOLERANCE . . . . . . . . . . . . . . . . . . . . . 0.0100
 ALL DATA CONSIDERED AS A SINGLE GROUP

 MULTIPLE R              0.6680              STD. ERROR OF EST.          0.1987
 MULTIPLE R-SQUARE       0.4463

 ANALYSIS OF VARIANCE
                            SUM OF SQUARES      DF     MEAN SQUARE        F RATIO     P(TAIL)
          REGRESSION                2.9919       3          0.9973         25.253      0.0000
          RESIDUAL                  3.7123      94          0.0395

                                                       STD. REG
    VARIABLE             COEFFICIENT   STD. ERROR        COEFF          T    P(2 TAIL) TOLERANCE   VARIABLE LABEL...

 INTERCEPT                  -0.18318
 E2031P        3             0.07126      0.01010        0.960      7.053     0.0000      0.31810 1970: Percent farms: Corporate ownership
 D5031F       11            -0.07346      0.01767       -0.582     -4.157     0.0001      0.30008 1970: Per farm expenditure: other chemical
 CCDB0612     34         0.83448E-04 0.30559E-04         0.235      2.731     0.0075      0.79765 1970: Retail sales establishments

 Number of integer words of storage used in preceding    problem 7068
 Elapsed time:       0.07 minutes.
```

TABLE D-23

TABLE D-24

```
                                                                     SAS                                  21:26 MONDAY, FEBRUARY 25, 1985  2

DEP VARIABLE: NEW11     PCT. EMPLOYED IN SERVICES 1980
                                                              ANALYSIS OF VARIANCE

                                                  SUM OF           MEAN
                           SOURCE      DF        SQUARES         SQUARE        F VALUE        PROB>F

                           MODEL        2       181.1819       90.59096          6.754        0.0018
                           ERROR       93       1247.324       13.41209
                           C TOTAL     95       1428.506

                               ROOT MSE         3.662251       R-SQUARE         0.1268
                               DEP MEAN         17.85015       ADJ R-SQ         0.1081
                               C.V.             20.51664

                                                              PARAMETER ESTIMATES

                         PARAMETER         STANDARD     T FOR H0:                       STANDARDIZED
VARIABLE    DF            ESTIMATE            ERROR    PARAMETER=0     PROB > |T|           ESTIMATE      TOLERANCE

INTERCEP     1            16.05275        0.4831008         37.368         0.0001                  0              .
V10          1     -0.000263629      .0000965219 3         -2.731         0.0075          -0.268139      0.9741552
V1208        1     0.000228055 2     0.0001146953          1.988         0.0497           0.195206      0.9741552

                      VARIABLE
VARIABLE    DF           LABEL

INTERCEP     1     INTERCEPT
V10          1     1978 AVE SIZE OF FARMS (ACRES)
V1208        1     1978 NO. HIRED WORKERS, 150 DAYS OR MORE
```

TABLE D-24

D22   TABLE D-25

```
                                                 SAS                                   21:26 MONDAY, FEBRUARY 25, 1985  1

DEP VARIABLE: NEW10    PCT. EMPLOYED IN MFG. 1980
                                          ANALYSIS OF VARIANCE

                                  SUM OF         MEAN
                SOURCE    DF     SQUARES        SQUARE       F VALUE       PROB>F

                MODEL      1    332.2057      332.2057        12.726       0.0006
                ERROR     94    2453.827      26.10455
                C TOTAL   95    2786.033

                   ROOT MSE     5.109261      R-SQUARE        0.1192
                   DEP MEAN     9.035417      ADJ R-SQ        0.1099
                   C.V.         56.23584

                                          PARAMETER ESTIMATES

                  PARAMETER      STANDARD     T FOR H0:                 STANDARDIZED
VARIABLE  DF       ESTIMATE         ERROR   PARAMETER=0   PROB > |T|        ESTIMATE     TOLERANCE

INTERCEP   1       10.12673     0.5976024        16.946       0.0001               0             .
V10        1  -0.000474126  0.0001329077        -3.567       0.0006       -0.345311             1

                VARIABLE
VARIABLE  DF      LABEL

INTERCEP   1  INTERCEPT
V10        1  1978 AVE SIZE OF FARMS (ACRES)
```

TABLE D-25

APPENDIX E

Regression Equations for Agricultural Technology X Social Conditions

TABLE E-1

```
                                             SAS                              17:05 WEDNESDAY, FEBRUARY 2
XFARMPOP 1970-1980 Change: FARM POPULATION
                                                ANALYSIS OF VARIANCE

                                          SUM OF          MEAN
                     SOURCE     DF       SQUARES        SQUARE        F VALUE        PROB>F

                     MODEL       9      1.204787     0.1338653          1.900        0.0642
                     ERROR      76       5.35424    0.07045053
                     C TOTAL    85      6.559028

                        ROOT MSE       0.2654252      R-SQUARE         0.1837
                        DEP MEAN       -0.232316      ADJ R-SQ         0.0870
                        C.V.            -114.252

                                               PARAMETER ESTIMATES

                          PARAMETER       STANDARD     T FOR HO:                   STANDARDIZED
        VARIABLE   DF      ESTIMATE          ERROR   PARAMETER=0    PROB > |T|         ESTIMATE       TOLERANCE

        INTERCEP    1     -0.252311     0.09230104        -2.734        0.0078                0               .
        SIZELOHI    1     -0.159977      0.0809501        -1.976        0.0518        -0.256403       0.6380864
        SIZEHIHI    1     -0.205285     0.08940327        -2.296        0.0244        -0.324331       0.5383606
        SIZEHILO    1    0.01872932     0.08947653         0.209        0.8348       0.02758949       0.6182769
        CHEMLOHI    1    0.09227513     0.08976509         1.028        0.3072        0.1534539       0.4819957
        CHEMHIHI    1      0.234496      0.1139504         2.058        0.0430        0.3222117       0.4381286
        CHEMHILO    1     0.1378575     0.09616697         1.433        0.1558        0.2379118       0.3899451
        MACHLOHI    1    0.08714001     0.08802689         0.990        0.3254        0.1283629       0.6388084
        MACHHIHI    1    -0.0536556     0.08352056        -0.643        0.5223       -0.0892797       0.5567642
        MACHHILO    1    -0.0380494      0.1049734        -0.362        0.7180       -0.0548691       0.4687339

                        VARIABLE
        VARIABLE   DF     LABEL

        INTERCEP    1   INTERCEPT
        SIZELOHI    1   Lo farm size 70; Hi chang in size: 70-80
        SIZEHIHI    1   Hi farm size 70; Hi chang in size: 70-80
        SIZEHILO    1   Hi farm size 70; Lo chang in size: 70-80
        CHEMLOHI    1   Lo chem use 70; Hi chang in use: 70-80
        CHEMHIHI    1   Hi chem use 70; Hi chang in use: 70-80
        CHEMHILO    1   Hi chem use 70; Lo chang in use: 70-80
        MACHLOHI    1   Lo $Machine 70; Hi chang in value: 70-80
        MACHHIHI    1   Hi $Machine 70; Hi chang in value: 70-80
        MACHHILO    1   Hi $Machine 70; Lo chang in value: 70-80
```

TABLE E-1

TABLE E-2

```
                                               SAS                                 17:01 WEDNESDAY, FEBRUARY 2
XMDINCOM 1970-1980 change: MEDIAN FAMILY INC
                                       ANALYSIS OF VARIANCE

                                      SUM OF           MEAN
                 SOURCE      DF      SQUARES          SQUARE         F VALUE         PROB>F

                 MODEL        9     12.88083        1.431203          4.961          0.0001
                 ERROR       76     21.92353       0.2884675
                 C TOTAL     85     34.80435

                    ROOT MSE      0.5370917        R-SQUARE          0.3701
                    DEP MEAN       4.293918        ADJ R-SQ          0.2955
                    C.V.            12.5082

                                       PARAMETER ESTIMATES

                        PARAMETER        STANDARD     T FOR H0:                    STANDARDIZED
VARIABLE    DF           ESTIMATE           ERROR   PARAMETER=0    PROB > |T|          ESTIMATE      TOLERANCE

INTERCEP     1           4.948415       0.1867725        26.494        0.0001                 0              .
SIZELOHI     1           0.142011       0.1638037         0.867        0.3887        0.09880756      0.6380864
SIZEHIHI     1          0.1173236       0.1809088         0.649        0.5186        0.08046755      0.5383606
SIZEHILO     1          0.1168935       0.1810571         0.646        0.5205        0.07475067      0.6182769
CHEMLOHI     1          -0.297744        0.161641        -1.639        0.1053         -0.214951      0.4819957
CHEMHIHI     1          -0.571222       0.2305802        -2.477        0.0155         -0.340733      0.4381286
CHEMHILO     1          -0.550839       0.1945993        -2.831        0.0059         -0.412717      0.3899451
MACHLOHI     1          -0.406032       0.1781237        -2.279        0.0254         -0.259648      0.6388084
MACHHIHI     1          -0.478721       0.1690051        -2.833        0.0059         -0.345604      0.5567642
MACHHILO     1           -0.68509       0.2124151        -3.225        0.0019         -0.428875      0.4687339

                VARIABLE
VARIABLE    DF     LABEL

INTERCEP     1  INTERCEPT
SIZELOHI     1  Lo farm size 70; Hi chang in size: 70-80
SIZEHIHI     1  Hi farm size 70; Hi chang in size: 70-80
SIZEHILO     1  Hi farm size 70; Lo chang in size: 70-80
CHEMLOHI     1  Lo chem use 70; Hi chang in use: 70-80
CHEMHIHI     1  Hi chem use 70; Hi chang in use: 70-80
CHEMHILO     1  Hi chem use 70; Lo chang in use: 70-80
MACHLOHI     1  Lo $Machine 70; Hi chang in value: 70-80
MACHHIHI     1  Hi $Machine 70; Hi chang in value: 70-80
MACHHILO     1  Hi $Machine 70; Lo chang in value: 70-80
```

TABLE E-2

```
                                                    SAS                                         17:03 WEDNESDAY, FEBRUARY 2
 TABLE E-3
NEW7      PERCENT UNEMPLOYED 1980
                                              ANALYSIS OF VARIANCE

                                          SUM OF          MEAN
                    SOURCE      DF       SQUARES        SQUARE         F VALUE          PROB>F

                    MODEL        9        331.77      36.86334           5.775          0.0001
                    ERROR       76      485.1062      6.382977
                    C TOTAL     85      816.8762

                       ROOT MSE         2.526455      R-SQUARE          0.4061
                       DEP MEAN         4.895975      ADJ R-SQ          0.3358
                       C.V.              51.6027

                                              PARAMETER ESTIMATES


                           PARAMETER       STANDARD      T FOR H0:                       STANDARDIZED
 VARIABLE    DF             ESTIMATE          ERROR    PARAMETER=0      PROB > |T|          ESTIMATE        TOLERANCE

 INTERCEP     1             4.405794      0.8785695          5.015          0.0001                 0                .
 SIZELOHI     1             -2.25525      0.7705253         -2.927          0.0045         -0.323892        0.6380864
 SIZEHIHI     1             -1.95554       0.850987         -2.298          0.0243         -0.276847        0.5383606
 SIZEHILO     1             -1.11102      0.8516843         -1.305          0.1960         -0.146652        0.6182769
 CHEMLOHI     1           0.07815207       0.854431          0.091          0.9274        0.01164596        0.4819957
 CHEMHIHI     1             3.675764       1.084639          3.392          0.0011          0.452949        0.4381286
 CHEMHILO     1              3.73867      0.9153864          4.084          0.0001         0.5781552        0.3899451
 MACHLOHI     1            0.6477731      0.8378858          0.773          0.4419        0.08550463        0.6388084
 MACHHIHI     1            -0.561466      0.7949923         -0.706          0.4822        -0.0836678        0.5567642
 MACHHILO     1            -0.552286      0.9991913         -0.553          0.5821        -0.0713651        0.4687339


                    VARIABLE
 VARIABLE    DF       LABEL

 INTERCEP     1    INTERCEPT
 SIZELOHI     1    Lo farm size 70; Hi chang in size: 70-80
 SIZEHIHI     1    Hi farm size 70; Hi chang in size: 70-80
 SIZEHILO     1    Hi farm size 70; Lo chang in size: 70-80
 CHEMLOHI     1    Lo chem use 70; Hi chang in use: 70-80
 CHEMHIHI     1    Hi chem use 70; Hi chang in use: 70-80
 CHEMHILO     1    Hi chem use 70; Lo chang in use: 70-80
 MACHLOHI     1    Lo $Machine 70; Hi chang in value: 70-80
 MACHHIHI     1    Hi $Machine 70; Hi chang in value: 70-80
 MACHHILO     1    Hi $Machine 70; Lo chang in value: 70-80
```

TABLE E-3

TABLE E-4

```
                                              SAS                              17:03 WEDNESDAY, FEBRUARY 2
XPFAMPOV 1970-1980 Change: % FAM BELOW POVERTY
                                     ANALYSIS OF VARIANCE

                                     SUM OF          MEAN
               SOURCE      DF       SQUARES        SQUARE        F VALUE         PROB>F

               MODEL        9     0.6206673    0.06896304          2.713         0.0086
               ERROR       76      1.931825    0.02541876
               C TOTAL     85      2.552493

                  ROOT MSE        0.1594326      R-SQUARE         0.2432
                  DEP MEAN        -0.184118      ADJ R-SQ         0.1535
                  C.V.             -86.5928

                                     PARAMETER ESTIMATES

                        PARAMETER        STANDARD    T FOR H0:                   STANDARDIZED
VARIABLE     DF          ESTIMATE           ERROR  PARAMETER=0    PROB > |T|         ESTIMATE        TOLERANCE

INTERCEP      1           -0.3903      0.05544235       -7.040        0.0001                0                .
SIZELOHI      1        0.03607772       0.0486242        0.742        0.4604       0.09269191        0.6380864
SIZEHIHI      1         0.1056936      0.05370175        1.968        0.0527        0.2676947        0.5383606
SIZEHILO      1        0.06737564      0.05374575        1.254        0.2138        0.1590971        0.6182769
CHEMLOHI      1        0.06613006      0.05391908        1.597        0.1143        0.2296072        0.4819957
CHEMHIHI      1         0.1370836      0.06844642        2.003        0.0488        0.3019457        0.4381286
CHEMHILO      1         0.1422494      0.05776569        2.463        0.0161        0.3935262        0.3899451
MACHLOHI      1        0.03538969        0.052875        0.669        0.5053       0.08356722        0.6388084
MACHHIHI      1          0.110486      0.05016819        2.202        0.0307        0.2945357        0.5567642
MACHHILO      1        0.07593959      0.06305422        1.204        0.2322        0.1755439        0.4687339

                  VARIABLE
VARIABLE     DF      LABEL

INTERCEP      1   INTERCEPT
SIZELOHI      1   Lo farm size 70; Hi chang in size: 70-80
SIZEHIHI      1   Hi farm size 70; Hi chang in size: 70-80
SIZEHILO      1   Hi farm size 70; Lo chang in size: 70-80
CHEMLOHI      1   Lo chem use 70; Hi chang in use: 70-80
CHEMHIHI      1   Hi chem use 70; Hi chang in use: 70-80
CHEMHILO      1   Hi chem use 70; Lo chang in use: 70-80
MACHLOHI      1   Lo $Machine 70; Hi chang in value: 70-80
MACHHIHI      1   Hi $Machine 70; Hi chang in value: 70-80
MACHHILO      1   Hi $Machine 70; Lo chang in value: 70-80
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TABLE E-4

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TABLE E-5                                    SAS                       17:06 WEDNESDAY, FEBRUARY 2
POVINDEU Unrelated Individuals in poverty: 1980
                                     ANALYSIS OF VARIANCE

                                   SUM OF          MEAN
                 SOURCE     DF    SQUARES        SQUARE       F VALUE       PROB>F

                 MODEL       9    533.744      59.30489         1.791       0.0834
                 ERROR      76   2517.228      33.12142
                 C TOTAL    85   3050.972

                    ROOT MSE     5.755121     R-SQUARE         0.1749
                    DEP MEAN     14.64419     ADJ R-SQ         0.0772
                    C.V.          39.2997

                                     PARAMETER ESTIMATES

                     PARAMETER      STANDARD     T FOR H0:                   STANDARDIZED
VARIABLE   DF         ESTIMATE         ERROR   PARAMETER=0   PROB > |T|          ESTIMATE    TOLERANCE

INTERCEP    1         11.90532      2.001331         5.949       0.0001                 0            .
SIZELOHI    1         3.477419      1.755213         1.981       0.0512         0.2584181    0.6380864
SIZEHIHI    1         4.959341        1.9385         2.558       0.0125          0.363293    0.5383606
SIZEHILO    1         4.560217      1.940088         2.351       0.0213          0.311464    0.6182769
CHEMLOHI    1        -0.490045      1.946345        -0.252       0.8019        -0.0377859    0.4819957
CHEMHIHI    1        0.8277767      2.470746         0.335       0.7385        0.05273752    0.4381286
CHEMHILO    1         4.129637      2.085193         1.980       0.0513         0.3304482    0.3899451
MACHLOHI    1        -0.360831      1.908656        -0.200       0.8424        -0.0260108    0.6388084
MACHHIHI    1         -2.94061      1.810947        -1.624       0.1086         -0.226741    0.5567642
MACHHILO    1         -4.46371      2.276101        -1.961       0.0535         -0.298453    0.4667339

                 VARIABLE
VARIABLE   DF      LABEL

INTERCEP    1   INTERCEPT
SIZELOHI    1   Lo farm size 70; Hi chang in size: 70-80
SIZEHIHI    1   Hi farm size 70; Hi chang in size: 70-80
SIZEHILO    1   Hi farm size 70; Lo chang in size: 70-80
CHEMLOHI    1   Lo chem use 70; Hi chang in use: 70-80
CHEMHIHI    1   Hi chem use 70; Hi chang in use: 70-80
CHEMHILO    1   Hi chem use 70; Lo chang in use: 70-80
MACHLOHI    1   Lo $Machine 70; Hi chang in value: 70-80
MACHHIHI    1   Hi $Machine 70; Hi chang in value: 70-80
MACHHILO    1   Hi $Machine 70; Lo chang in value: 70-80
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TABLE E-5

TABLE E-6

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                                                      SAS                                    17:05 WEDNESDAY, FEBRUARY 2
XRTLSTOR 1970-1980 Change: RETAIL ESTABLISHMENTS
                                              ANALYSIS OF VARIANCE

                                         SUM OF          MEAN
                      SOURCE     DF     SQUARES        SQUARE       F VALUE       PROB>F

                      MODEL       9    1.573895     0.1748773         4.327       0.0002
                      ERROR      76    3.071372    0.04041279
                      C TOTAL    85    4.645267

                          ROOT MSE     0.2010293      R-SQUARE       0.3388
                          DEP MEAN    -0.0849802      ADJ R-SQ       0.2605
                          C.V.           -236.56

                                              PARAMETER ESTIMATES


                       PARAMETER         STANDARD     T FOR H0:                    STANDARDIZED
 VARIABLE   DF          ESTIMATE            ERROR   PARAMETER=0     PROB > |T|         ESTIMATE       TOLERANCE

 INTERCEP    1        -0.0259542       0.06990752        -0.371         0.7115                0               .
 SIZELOHI    1         -0.150092       0.06131047        -2.448         0.0167        -0.285849       0.6380864
 SIZEHIHI    1         -0.167292       0.06771278        -2.471         0.0157        -0.314067       0.5383606
 SIZEHILO    1         0.1046696       0.06776327         1.547         0.1259        0.1835632       0.6182769
 CHEMLOHI    1        -0.0669197       0.06798682        -0.984         0.3281         -0.13224       0.4819957
 CHEMHIHI    1         0.0590676       0.08630442         0.692         0.4915       0.09745538       0.4381286
 CHEMHILO    1        0.03970031       0.07283703         0.545         0.5873       0.08141305       0.3899451
 MACHLOHI    1        0.02071535       0.06667033         0.311         0.7569       0.03626092       0.6388084
 MACHHIHI    1        -0.0647526        0.0632573        -1.024         0.3093        -0.127957       0.5567642
 MACHHILO    1        0.06664275       0.07950536         0.838         0.4045         0.114195       0.4687339


                   VARIABLE
 VARIABLE   DF       LABEL

 INTERCEP    1   INTERCEPT
 SIZELOHI    1   Lo farm size 70; Hi chang in size: 70-80
 SIZEHIHI    1   Hi farm size 70; Hi chang in size: 70-80
 SIZEHILO    1   Hi farm size 70; Lo chang in size: 70-80
 CHEMLOHI    1   Lo chem use 70; Hi chang in use: 70-80
 CHEMHIHI    1   Hi chem use 70; Hi chang in use: 70-80
 CHEMHILO    1   Hi chem use 70; Lo chang in use: 70-80
 MACHLOHI    1   Lo $Machine 70; Hi chang in value: 70-80
 MACHHIHI    1   Hi $Machine 70; Hi chang in value: 70-80
 MACHHILO    1   Hi $Macnine 70; Lo chang in value: 70-80
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TABLE E-6

TABLE E-7

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                                              SAS                                   17:05 WEDNESDAY, FEBRUARY 2
XRTLVOLM 1970-1980 Change: RETAIL SALES VOLUME
                                    ANALYSIS OF VARIANCE

                                     SUM OF          MEAN
                 SOURCE     DF      SQUARES        SQUARE        F VALUE       PROB>F

                 MODEL       9     81.39561      9.043957          3.839       0.0005
                 ERROR      76     179.0396      2.355784
                 C TOTAL    85     260.4352

                    ROOT MSE       1.534856      R-SQUARE         0.3125
                    DEP MEAN       3.781324      ADJ R-SQ         0.2311
                    C.V.           40.59045

                                    PARAMETER ESTIMATES

                    PARAMETER       STANDARD      T FOR H0:                   STANDARDIZED
VARIABLE   DF        ESTIMATE          ERROR    PARAMETER=0    PROB > |T|         ESTIMATE      TOLERANCE

INTERCEP    1        4.804703       0.533743          9.002        0.0001                0              .
SIZELOHI    1        -1.05531      0.4681047         -2.254        0.0271        -0.268419      0.6380364
SIZEHIHI    1       -0.777816      0.5169863         -1.505        0.1366         -0.19502      0.5383606
SIZEHILO    1        1.204823      0.5174099          2.329        0.0225        0.2816534      0.6182769
CHEMLOHI    1        -1.11938      0.5190786         -2.156        0.0342        -0.295421      0.4819957
CHEMHIHI    1       -0.189603      0.6589332         -0.288        0.7743       -0.0413449      0.4381286
CHEMHILO    1       -0.365245      0.5561093         -0.657        0.5133        -0.100032      0.3899451
MACHLOHI    1        -0.20509      0.5090272         -0.403        0.6881       -0.0479443      0.6388084
MACHHIHI    1       -0.586039      0.4829688         -1.213        0.2287        -0.154664      0.5567642
MACHHILO    1       -0.381146      0.6070225         -0.628        0.5320        -0.087225      0.4687339

                VARIABLE
VARIABLE   DF      LABEL

INTERCEP    1   INTERCEPT
SIZELOHI    1   Lo farm size 70; Hi chang in size: 70-80
SIZEHIHI    1   Hi farm size 70; Hi chang in size: 70-80
SIZEHILO    1   Hi farm size 70; Lo chang in size: 70-80
CHEMLOHI    1   Lo chem use 70; Hi chang in use: 70-80
CHEMHIHI    1   Hi chem use 70; Hi chang in use: 70-80
CHEMHILO    1   Hi chem use 70; Lo chang in use: 70-80
MACHLOHI    1   Lo $Machine 70; Hi chang in value: 70-80
MACHHIHI    1   Hi $Machine 70; Hi chang in value: 70-80
MACHHILO    1   Hi $Machine 70; Lo chang in value: 70-80
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TABLE E-7

Background Paper No. 3

Emerging Agricultural Technologies, Farm Size, Public Policy, and Rural Communities: The Great Plains and the West

Jan L. Flora and Cornelia Butler Flora
Kansas State University

July 1985

Office of Technology Assessment
U.S. Congress

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

Emerging Agricultural Technologies, Farm Size, Public Policy, and Rural Communities: The Great Plains and the West[1]

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Waters Hall
Kansas State University
Manhattan, Kansas 66506

I. Introduction and Objectives of the Study

A. Introduction

This study attempts to determine how changes in the structure of agriculture affect the welfare of agricultural communities in the Great Plains and West of the United States. Agricultural structure results in part from changes in technology and in part from changes in public policy. Public policy frequently channels technological change. Changes in either technology or policy may affect community vitality through agricultural structure.

The structure of agriculture is in part defined by the size distribution of farms. The Great Plains and West have few small farms. Therefore, changes in the structure of agriculture are indexed by changes in the number of moderate-sized and large farms.

Agricultural technology tends to be enterprise specific. Enterprise mixes tend to become systematized into farming systems, implying different patterns of land, capital, and labor utilization, as well as differential responses to technological innovation. Farming systems evolve in response to the ecology of an area (rainfall, soil quality, climate and topography) and to historically established institutional patterns, such as access to land, capital, and labor. The link between agricultural structure and community welfare is specified by the farming system, which in turn is linked to technology and policy. This study deals only with agricultural counties and dominant farming systems types west of the Missouri River. Counties that changed farming systems, such as those counties that went out of cotton production or into sunflower production, are excluded from the analysis. Such shifts involve key technological and economic decisions affecting the structure of agriculture, but they require further detailed analysis.

Despite the emphasis on change in agricultural structures in this analysis, it should be recognized that many other factors have affected agricultural counties, including increased Federal transfer payments, particularly to retired individuals, declining service sector wages, and changing petroleum prices. Thus, the models of changes in community viability are only partially specified.

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[1] Contribution 85-536-B from the Kansas Agricultural Experiment Station. Appreciation is expressed to LLoyd Bender and Elise Boulding for commenting on an earlier draft, to Arlin Feyerherm and Arthur Dayton of the Kansas State University Statistics Department for statistical consultation, to Janet Bosomworth, T. Robert Harris, and Edward Gregory for computer work, and to Eileen Schofield for editing the final manuscript.

B. Definition of rural agricultural communities

We examined communities that are primarily agricultural or counties with federal lands which have a strong agricultural component, and whose agriculture is currently dominated by wheat or livestock or both. The two types of counties are identified by Bender, et. al (1985). Counties are located in the West and the Great Plains states.

Agriculture will have some impact on communities in counties in which agriculture is not a principal economic base, but we include only counties for which agriculture was a major contributor to the economy and to employment. In other rural counties, too many possible causal variables contribute to community change. The communities in the counties identified are relatively small, with relatively large and diffusely populated hinterlands; approximately 1,000 rural communities are to be found in the sample counties.

C. Major forces potentially affecting rural communities

Federal policy, including land policy, fiscal policy, monetary policy, and commodity programs, has affected the development of rural communities in this region, through farm structure. State policies related to water, particularly the separation of water rights from land use rights, may prove a major factor in the region, as both the depletion of nonrenewable aquifers and expanding urban demands make water more scarce.

Wheat, beef, and feed grains are parts of the farming systems dominate in the counties analyzed. Wheat has been a strongly supported commodity. Wheat associations and general farm organizations lobby hard for Federal support programs. However, the decline of the farm coalition in the U.S. Congress implies a decrease in wheat-based transfer payments.

Except for times of war, wheat has been predominantly a domestic crop for the United States, with different parts of the region specializing in different types of wheat for different end-use products. By the early 1970s, however, the destination of the majority of U.S. wheat shifted from domestic to foreign markets. Much of this change was spurred by purchases by less developed countries, particularly those for whom oil wealth afforded them foreign exchange, either directly or through bank credit. Such purchases helped those countries maintain a cheap food policy at home. For developing countries, the error of a cheap food policy has been made evident through declining domestic food production and increased foreign debt. The debt crisis of many of U.S. cash customers, such as Nigeria and Indonesia, is unlikely to be reversed in the foreseeable future. Further, the strong American dollar overprices our wheat on the world market, making it even less likely that international wheat sales will continue at the present level, much less increase. The lack of government controls on the quality of our wheat exports has led to charges of selling dirty wheat abroad, which has further disturbed our markets. Finally, the trend for most wheat on the world market is for sales to occur through government-to-government purchase contracts.

The U.S. to date has only one -- with the Soviet Union. Unless there is more activity on the part of government in marketing -- not just in promoting -- U.S. wheat, our share of the international market will continue to fall.

While not receiving a direct subsidy or support like wheat, beef raisers in many of the counties examined have received indirect subsidies through low-price leases of federal land for grazing. Beef has been highly protected import competition, both directly through tariffs and indirectly through high health standards, particularly those related to health problems arising from low capital input, such has foot and mouth disease and tapeworm. Until recently, the U.S. has not developed standards related to potential health hazards of high technology beef production, such as the use of growth hormones and antibiotics in feed. Any change in these standards, domestically or internationally, could change the conditions for beef production and for the communities that depend on it. In addition, a secular decline in the demand for beef, plus a shift in the type of beef preferred by consumers could lead to a shift away from feedlots to grass-fed beef. Finishing fewer cattle on grass could cut production costs, but decrease the employment generated and the capital circulated in feedlot activities in some rural communities in the eastern part of the region and redistribute production to areas in the western part of the region.

II. Relationship of Wheat- and Livestock-Based Farming Systems to Community Welfare and to Public Policy

A. Methodology of County Selection

Agricultural counties in the Great Plains and the West provide the units of analysis linking the structure of agriculture to community. The boundary of the Great Plains and the West is defined chiefly by amount of rainfall. Annual precipitation in the Great Plains ranges from more than 40 inches in eastern Texas to less than 20 inches along the western border of the region. In the area of the West considered agricultural, annual precipitation ranges from 25 inches or less in most river valleys to 6 inches or less in intermountain basins and southern desert areas. Much of the land outside the river valleys is owned by Federal or State governments, which regulate access by agriculturalists, principally for grazing.

The tier of states from Texas to North Dakota are included in the Great Plains, as well as northeast New Mexico, the eastern half of Colorado, the eastern portion of Montana, and the westernmost part of Minnesota. The western half of South Dakota and northwestern Nebraska, areas in which grazing on federally owned public land is common, are considered part of the West. The frost-free period in the areas under consideration varies from less than 100 days in North Dakota to over ten months in southern Texas.

Wheat production (spring wheat in the north and winter wheat in the south) dominates the Great Plains. Corn, an increasing proportion of which is irrigated from east to west, is an important crop in southeastern South Dakota and eastern Nebraska and Kansas, which, when rotated with soybeans and integrated with hog-cattle operations, makes the dominant farming systems in those areas most like those in the corn belt. Grain sorghum is an important crop further west in Nebraska, Kansas, and Texas, whereas cotton dominates in parts of Oklahoma and Texas. However, much of the land, especially in the western half of the region, is in native range whose productivity is limited by low precipitation.

The 17 states of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Colorado, Montana, Wyoming, Idaho, Utah, Arizona, Nevada, California, Oregon, and Washington all potentially had agricultural counties in which agricultural systems of grains, livestock (excluding dairy), or combined grains and livestock predominated. In these 17 states, 351 counties were classified as agricultural by Bender, et. al (1985).

Using crop and livestock data from the 1974 and 1982 agricultural censuses, the farming system predominating in each county was determined, as well as whether or not irrigation was an important factor in that farming system. Initial analysis indicated that irrigation was important in a number of the counties, and that the presence of irrigation was reflected in the emergent farming system. Grain/livestock counties with irrigation tended to diversify into mixed grains (corn, sorghum, wheat, and cattle), whereas livestock counties with irrigation simply increased hay production for cold weather feeding. Thus, four major farming systems were identified for analysis: wheat, livestock, wheat/livestock, and mixed crops/livestock.

Counties were eliminated from the analysis that had 25 percent or more of their production value as dairy, poultry, cotton, potatoes, sugar beets, rice, vegetables and fruits, and oil seeds, particularly sunflower seeds and soybeans. These last two crops have had a substantial impact on a number of counties in the region, and require separate analysis. Counties on the eastern edge of the area that had predominately corn belt agricultural systems, in which soybeans and hogs predominated (over 50%) in the grain-livestock mix also were eliminated from this analysis. These commodities have different technologies, different organizational contraints on production, and result from different ecological factors. One hundred thirty-four counties were eliminated as having dominant farming systems that did not fit the technologies under assessment, i.e., livestock, wheat, and related crops.

To the remaining 217 counties were added 16 counties, which Bender, et al. did not classify as agricultural counties, but which in 1982 had at least 25 percent of their economically active population engaged in farming, and two counties in the northeast corner of Minnesota, which were part of a wheat-dominated farming system. One livestock county in Texas was eliminated because of its very small population and the fact that it was consistently an outlier on most important variables. These 234 counties then were classified as 1) wheat, 2) livestock, 3) wheat/livestock or 4) mixed crops/livestock. No county in Arizona or California was classified under one of these four farming systems.

A county was classified as a wheat county if wheat was its primary grain, and grains provided at least 75% of the value of agricultural product sold for 1974 - 1982. Thirty-three counties were predominantly wheat counties. Counties were classified as livestock if at least 75% of the value of agricultural products produced came from livestock, excluding hogs, poultry, and dairy. These counties had cattle and sheep as their major livestock. Eighty-four counties were classified as livestock counties. Counties that had less than 75% of their products sold as either small grains or livestock were classified as mixed. One hundred seventeen counties were classified as mixed.

Mixed crop and livestock counties with over 25,000 acres in irrigation in 1982 were tentatively defined as irrigated counties. The cropping mix then was examined. If the irrigation did not change the farming system to emphasize corn production over wheat and sorghum production, it continued to be classified as either wheat or wheat/livestock. However, if the mix of grains in the mixed counties shifted, it was assumed that feed lots predominated in the livestock sector, and distinguishing a different mixed farming system was appropriate. Forty-five of the mixed counties were classified as mixed crops/livestock. The remaining 72 were classified as wheat-livestock counties. In the livestock counties, irrigation means irrigated pasture. Although 19 of the livestock counties had over 25,000 irrigated acres, the farming system was not substantially changed.

Agricultural counties included in the sample are identified in the maps in Figures 1A-D in the appendix. Each map shows the counties with a particular predominant farming system.

In 1982, the 234 counties in the sample produced over one-fourth of the agricultural products sold in the 15 states from which counties were included (excluding Minnesota, most of which is part of the Midwestern dairy-corn belt region), and a slightly higher percentage of total agricultural land in the region (26.6 and 28.5 percent, respectively). They represent almost exactly one third and one half of the livestock and wheat production, respectively, of the 15-state area.

B. Technology and the Four Major Farming Systems of the Region

The four major farming systems — wheat, livestock, wheat/livestock, and mixed crops/livestock — differ according to use of capital, labor, land, and management. As a result, they utilize available technology differently and have differing potentials for technology adoption in the next 15 years.

1. Wheat production and wheat counties

There are three major areas of wheat production in the region, each growing different types of wheat under a different kind of land use. With the exception of mechanization, the technology that has been generated has been area specific. The technology generated since World War II, again with the exception of mechanization, has come primarily from the public sector. Where there have been substantial shifts in cultural practices in wheat production over the past 50 years, those innovation have been based on 1) fertilizer application (which was massively adopted for wheat between 1955 and 1965), 2) reduced tillage practices (which for wheat can be considered to have begun in the late 1970s on a significant scale), and 3) breeding innovations to control disease, pests, and the effects of environmental hazards, such as hail, heat, and drought (initiated in the 1920s, but greatly accelerated after World War II; see J. Flora, 1986).

New varieties have been introduced in all the areas under consideration, with continuing increases in yield resulting. The risk-reducing aspects of the breeding program as well as the direct yield-enhancing breeding effort were as responsible for the increased yields. Breeding for stronger straw and shatter resistance began with the use of combines for harvesting, which gained momentum in the 1920s. That technological breakthrough substituted capital for labor greatly reduced labor use. The capital substitution was either direct, by purchasing equipment, or indirect, by hiring harvest crews with combines. Mechanical harvesting increased pressure to expand land holdings to make that machinery investment economical. However, the combine required that the grain remain longer in the field in order to dry adequately for storage. With the increased use of nitrogen fertilizer on wheat in the 1960s, wheat breeders had to respond with even shorter, thicker-strawed varieties in order to resist lodging. They also bred for shorter season varieties, in order to compensate for the longer time in the field prior to harvest and to resist pests that appeared during the pre-harvest period.

Larger machinery increased costs and was widely purchased during the sixties and most of the seventies. That long-term trend that leveled off by the end of the 1970s, in part because of changing factor costs of capital.

The radical increase of the cost of fuel as well as nitrogen fertilizer during the 1970s induced a number of cost-reducing technological shifts. Cost considerations have motivated a shift to minimum tillage operations, as well as continuing adoption of more resistant wheat varieties, which solve pest problems biologically rather than chemically.

In wheat production, timeliness of operation is crucial. Thus, good management, rather than either capital or labor, is the key input. Management is also the critical component of erosion control a particularly serious problem in the western and high plains wheat areas. Mechanisms to reduce erosion, particularly through increasing ground cover, need minimal technological inputs, but do require management commitment.

Cultural practices in the wheat areas are aimed at moisture storage, nutrient release and availability, and proper timing of operations. Management is a necessary aspect in optimizing production through these means. That dependence on management limits the potential effectiveness of very large wheat operations, as less attention can be paid to the crucial variable of timing of cultural practices. No technology is on the horizon to reduce the management component of wheat production.

The only potential technology that might seriously affect wheat counties is the biological fixation of nitrogen by the wheat plant. Otherwise, maintenance research will probably continue to increase output and lower input costs. Direct marketing mechanisms for individual farmers or cooperatives might increase the proportion of wheat generated income accruing to farmers and remaining in local communities.

A major technology shift that is occurring in wheat areas is the increased use of herbicides and minimum tillage implements to diversify cropping patterns and to get more crops off the land in a given time span, using the moisture thus conserved. The wheat-fallow rotation, with one crop in two years, is being replaced by including sunflower, sorghum, and even corn in a dryland farming sequence, giving up to four crops in five years. More effective herbicides will increase this tendency among the operators of larger-than-average farms, who can profitably invest in the new implements needed. Further, this technology requires a higher management input than conventional farming, and thus favors full-time over part-time farmers. Computer technology that can simulate agronomic and economic conditions can help fine-tune introduction of new crops and animals and improvement management practice for farming operations.

2. Livestock counties

Cow-calf operations predominate in the counties classified as livestock counties. These are extremely low management operations, where little technological innovation has occurred in the past 20 years. Much of the technology that exists for such operations, such as hormonal synchronization of estrus, artificial insemination, improved or fertilized pastures and even controlled breeding programs, has not been adopted, in part because of the management factor. The major capital investment on many of these operations is a pickup truck with a gun rack. Federal tax policies tend to favor investments in equipment and physical plant, rather than investment in other types of technology.

A minor technological innovation affecting cow-calf operations was the change in forage harvesting technology. Mower-conditioners were introduced in the western part of the region under analysis, whereas in the Great Plains, where rain is more a threat, there was a move to package hay in large round bales, which are less susceptible to damage from precipitation when stored outdoors than conventional rectangular hay bales.

Technology for providing water for cattle is particularly important in the west, but has changed little in the last 20 years. Because of the large size of operations, windmills are still the pumping method of choice. Little innovation in windmills is foreseen.

Two potential technologies have implications for the livestock counties. One is a bovine growth hormone that greatly increases the efficiency of weight gain in cattle. Its adoption depends, however, on its ease of application in terms of demands on management. Its use would decrease the time between calving and fattening, resulting in the sale of larger calves at a younger age. Assuming that larger operations would implant growth hormones first, the smaller operations adopting later would be disadvantaged through price declines resulting from greater, more efficient, production. Since major costs — breeding stock and land — are fixed, the impact of such an innovation on farm size would be less for cow-calf operations than for feedlots or dairy cattle.

A second new technology is computer-based telemarketing. Many cattle fattened in western feedlots are imported from the south or from Mexico. More efficient marketing procedures could reduce the costs of transportation by better distributing locally produced cattle to local feedlots. This would result in greater return to the producer, and could also serve to brake the increase in size of farm in livestock counties.

3. Wheat/Livestock counties

Wheat/livestock counties are dominated by farming systems that combine the cultivation of wheat with cow-calf operations and limited production of grain or forage sorghums, often fed on the farm. That combination of crop-animal enterprises allows for a rationalization of labor, land, and machinery use. As with the single-enterprise systems, little technological innovation in the past 20 years in livestock production actually has been adopted on a substantial scale, while the innovations in wheat production in that time have been readily adopted. Because of the generally higher management inputs already present in this farming system, compared to the straight livestock system, these farmers might be more likely to adopt the bovine growth hormone, particularly since, with continuing low grain prices, the number of calves raised on a given piece of land could increase considerably, offsetting the current trend of increase in farm size. As with the livestock counties, adoption would depend on the management demands of the technology, as well as its dependence on subsidiary provider enterprises, such as those required for artificial insemination.

Telemarketing, aided by complex computer hookups, could increase profitability for medium-sized wheat/livestock farms, by helping owners not only to market their calves and grain, but better decide when to feed wheat to their livestock and when to market it commercially.

4. Mixed Crops/Livestock Counties

The mixed crop and livestock system is the most complex and integrated of all the farming systems in the counties analyzed. These counties generally have irrigation from ground water, which has been shown by Albrecht, et al, 1984, and J. Flora, et al, 1977, to be associated with smaller increases in size of farm and greater population growth than is true for surrounding dryland counties. Those writers arguement that technology substitutes for land. While it is important to acknowledge adoption of irrigation technology in these counties as a technological strategy, which requires higher initial capital investment and more intensive management and labor inputs, it is also important to understand the change in land use that takes place. Farm operator flexibility is increased and the risk for the family is reduced.

A major economic shift that has accompanied the increase in irrigation in these counties during the 1970s is an increase in the number of feedlots, which have the potential of utilizing the variety of crops and animals produced in the counties. During that time period, there was a change in location of the fattening of cattle from farm to feedlot. Further, feedlots, along with the meat packing industry, moved west. These shifts were due less to technological innovations than to capital incentives, including lower costs for labor, land and less need to construct shelter for the cattle.

The move to feedlots shifted labor from the farm operator and unpaid family members, who managed cattle in conjunction with other productive activity, to hired labor. Labor per head of cattle is 75% less in large feedlots than in small farmer-fed cattle operations (Van Arsdall and Nelson, 1983: 31). This labor efficiency is due to 1) more mechanization, 2) lower fixed labor requirements, and 3) shorter feeding periods.

The innovations in feedlots over the past 20 years have been those that attempt to increase the weight gain per animal per day and decrease animal loss. Such technologies as antibiotic feed additives and other pest control mechanisms, while initially applied universally as preventatives, are increasingly used selectively in integrated pest management programs. For profitability of the feedlot, which generally receives a fee for each head fed per day, with a premium for fast weight gain, management of the disease and pest control technologies have been as important as the technologies themselves. In addition, technologies that increase feed efficiency, both hormonal injections or implants and feed additives, such as rumensin, which allows for wider feed use by decreasing acidosis and the resulting bloat, have been important for feedlots in the last decade. These have had positive impacts that lead to greater integration of the farming system, since, for example, rumensin allows for the feeding of wheat to feeder cattle when wheat prices are low.

Important new technologies will be those that increase feed efficiency and consistency. On one end of the technological pole is bovine growth hormone, which could greatly increase the capacity and efficiency of feedlot operations. On the other, biotechnology in sorghum (milo) breeding could increase the feed value of that grain, as well as decrease its variability, and thus allow milo to be substituted for corn as the feed grain of choice of feedlots, a substitution that must be made anyway as ground water decreases, resulting in a decline the local availability of corn, which requires alot of moisture.

Computer technology to rationalize feeding procedures is increasingly making it possible for farm feeder operations in the west to compete with commercial feedlots. This use of computer technology for larger family size operations can help recycle community resources and maintain medium-sized diversified operations. Although potentially integrative of local products, feedlots currently still import a great deal of feed as well as cattle for fattening. The advent of computer-based marketing linking farmer and feedlot should allow for more effective use of local supplies, which would decrease transportion costs for the feedlot operator. These technologies will benefit those feedlots with relatively high liquidity, and might favor the outside ownership of feedlots, separating ownership from management in the community because of their easier access to capital compared to family farmers.

C. Comparison of Results Among Counties of Different Farming System Types.

The four types of counties, defined by the dominant farming system in each county, are arranged in the tables according to diversity of that farming system. Livestock counties are the least diverse and the mixed crop-livestock counties (cattle-wheat-sorghum-corn counties) are the most diverse (See Table 1 for means on cropland, pastureland, and sales by commodity which validate the typology). This ordering also corresponds to intensivity of land use, except that the two middle groups of counties would be reversed: land in wheat counties is more intensively used than that in wheat/livestock counties, as is suggested by value of land and buildings per acre and value of machinery and equipment per acre (Table 2).

Table 2 shows means for size and production variables for the four county types. It should be recognized that we are using county averages, which ignore the substantial variation within counties. Farm size isinversely related to diversity. Farm sales (total and per acre) are greatest for the mixed crop-livestock farms, because of the high capital-to-land ratio of this type of agriculture, and the resultant high production per acre. Capital intensity is indexed by irrigation, which is highest in the mixed counties. Irrigation allows for high levels of production per acre and justifies a large per-acre investment, particularly since it is a risk-reducing technology. Mixed crop-livestock production in irrigated areas or areas of abundant

TABLE 1. DEFINING CHARACTERISTICS OF AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1978

Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
	(mean		scores*	)
Pasture and rangeland as percent of total farm acres, '78	72	29	48	35
Percent of total agricultural sales from livestock, '78	76	21	54	54
Cropland as percent of total farm acres, '78	25	66	50	62
Percent of total agricultural sales from grain, '78	8	69	31	35
Number of cases	(84)	(33)	(72)	(45)

* Means of county means.

rainfall allows for more flexible cropping and livestock combinations. It also provides the opportunity of expansion of production without the purchase of more land. It allows for incremental expansion, which the purchase of land does not. It requires medium rather than long term, indebtness.

Livestock counties, like mixed crop-livestock counties, had a majority of farm sales from holdings that produced over $100,000 in farm sales in 1978 (in contrast to wheat and wheat/livestock counties). Livestock monoculture historically and currently has attracted large producers partly because of its relatively low management input. However, this also makes it a viable option for small, part-time operators. Hence, the bimodal distribution of farm numbers by farm size for livestock counties (see Table 8). Stock cattle production also has been an attractive investment for persons with large nonfarm income, because of the attractive capital-gains tax provisions regarding stock cattle raising.

Table 3 presents population variables. The livestock counties are the only ones that experienced an increase in total population. They showed the greatest percentage growth in rural nonfarm population and the least percentage decline in farm population. These counties initially had the

TABLE 2. FARM CHARACTERISTICS OF AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1978

Farm-Related Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
	(mean		scores*)	
Average Size of farm (acres)	3410	1740	1619	1203
Value of land and buildings per farm ($1000)	554	525	397	475
Value of land and buildings per acre ($)	243	351	316	458
Value of machinery and equipment/ farm ($1000)	40	74	52	68
Value of machinery and equipment/ acre, $	26	54	44	67
Value of agricultural products sold per farm, $1000	103	63	60	137
Value of agricultural products sold per acre, $	60	41	50	125
Percent of land in farms which is irrigated (79)	5 (29)	3 (69)	3	15
Percent of agricultural sales from farms with $100,000+ sales	62	47	48	68
Number of cases	(84)	(33)	(72)	(45)

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* Means of county means.

lowest population base. Livestock counties were the least densely settled and the least economically diversified (in the sense of agriculture vs other economic sectors). According to Bender, in many livestock counties of the West

> . . . purchased supplies are minimal. Much of the household meat consumption is raised on the ranch, or is wild. The ranch forms a self-contained community with many of the services integrated into the operation rather than purchased. Ranch supplies typically are purchased in bulk from weekly or monthly trips to regional trade centers. In extreme cases, school children are boarded in a nearby town. Thus,

population is sparse, towns are very small and dispersed, and regional trade centers are also few and distant because specialized city services are not needed (personal communication, 1985).

TABLE 3. POPULATION CHARACTERISTICS OF AGRICULTURAL COUNTIES CLASSIFIED ACCORDING TO PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1970-80

Population Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop Livestock
	(mean	scores*	)	
Total county population, '80	4402	6261	4616	6044
Population per 1000 acres of agricultural land, '80	9.7	7.9	7.8	11.6
Rural farm population, %, '80	22	26	28	24
Urban population, %, '80	10	13	5	14
Rural non-farm population, %, '80	68	61	67	62
Percent change in total population, '70-'80	+ 5.1	- 3.1	- 2.1	- 0.7
Percent change in rural non-farm population, '70-'80	+31	+10	+19	+13
Percent change in rural farm population, '70-'80	-20	-25	-27	-25
Percent change in urban population, '70-'80	-1.2	+2.1	-0.1	+1.3
Number of cases	(84)	(33)	(72)	(45)

* Means of county means.

The growth of service-oriented activities throughout nonmetropolitan America had a more positive net impact on population in the 1970s in those agriculturally-dependent counties where ranchers purchased few inputs from the nearest community and provided many subsistence items from their own ranch. In other agriculturally dependent counties, the service-related population growth was more than balanced by a decline in numbers of farmers, and the attendant declines in farmers' consumption and locally purchased farm inputs.

Retail and wholesale services are positively related to farming system diversity, as is indicated in Table 4. However, the difference in per capita retail services has narrowed over the decade from 1967 to 1977. The decline in service availability was least in livestock counties and greatest in mixed crop and livestock counties.

TABLE 4. COMMUNITY-RELATED CHARACTERISTICS OF AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1967-77

Community Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
		(mean	scores[*])	
Retail establishments, #, '77	52	75	60	78
Retail establishments/1000 population, '77	12.4	13.2	13.1	12.8
Retail sales per capita, $, '77	1,995	2,422	2,286	2,929
Wholesale establishments, #, '77	11	25	16	23
Wholesale establishments/1000 population, '77	2.1	4.4	3.4	3.9
Wholesale sales per capita, $, '77	2821	6071	3717	5844
Percent change in number of retail establishments, 1967-77	-8	-13	-15	-17
Percent change in retail sales volume, 1967-77[**]	+ 3	-14	- 7	-15
Number of cases	(84)	(33)	(72)	(45)

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[*] Means of county means.

[**] The consumer price index in 1977 was 181.5 when 1967 was set at 100.

Measures of income and unemployment in predominantly rural counties are rather unreliable, since income measures are so dependent on level of farm prices and farm production, which vary considerably from one year to another. Unemployment is generally low in rural areas, although underemployment can sometimes be quite high. Income measures also tend to be distorted in agricultural households. Of all the income measures, the percent of families below poverty seems the most stable. The patterns of change in median family income and percent of families in poverty are consistent: livestock counties show the greatest poverty, but the greatest improvement in the decade of the 1970s (see Table 5). Measures of standard of living more direct than monetary income are probably more useful. Curiously, at both time periods, livestock counties had the lowest percentage of housing built before 1940.

TABLE 5. SOCIOECONOMIC CHARACTERISTICS OF THE POPULATION IN AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1969-1979

Socioeconomic Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
	(mean scores*)			
Median family income, $, '69 (in 1979 dollars)**	12,760	15,624	13,646	14,331
Median family income, $, '79	14,342	16,631	14,986	15,792
Percent change in median family income, 1969-79 ('79 dollars)**	+12	+ 6	+10	+10
Families below poverty, %, '69	19	11	16	14
Families below poverty, %, '79	16	11	15	12
Change in percent of families in poverty, 1969-79	-2.8	+0.1	-1.1	-1.1
Percent pre-1940 year-round housing:				
1970	47	51	53	53
1980	42	47	49	48
Percent unemployment, '80	4.0	4.6	3.5	2.0
Number of cases	(84)	(33)	(72)	(45)

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* Means of county means.

** The Consumer Price Index in 1969 was .505 when its 1979 value was set at 100.

Growing separation of labor, management, and capital from each other in on-farm agriculture would indicate that farming is becoming part of the modern industrial-type economy. That separation is occurring to a limited degree, but the trend is in the opposite direction for some variables. There are interesting differences between farm types as well. In the decade of the 1970s, there has been an increase of off-farm work by farm operators, a

TABLE 6. INTEGRATION OF FARMING INTO THE MODERN ECONOMY, FOR AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1969-78

Modern Economy Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
	(mean		scores)*	
Operators whose principal occupation is farming, %, '78	65	82	77	80
Operators who worked 100+ days off farm, %, '78	31	22	24	22
Change in percent of operators working 100+ days off farm, '69-78	+3.5	+1.7	+1.7	+0.7
Number of workers working 150+ days on farm/number of farms: '69	.40	.26	.17	.21
'78	.58	.48	.31	.42
Percent change in number of workers working 150+ days/year, '69-'78	69	80	89	95
Expenditures for hired labor/farm, $, '78	3,995	3,939	1,960	3,542
Percent change in expend. for hired labor, '69-'78 ('78 $$)**	128	130	111	168
Expenditures for contract labor/farm, $, '78	430	410	180	240
Expend. for hired & contract labor/value of machinery and equipment:				
1969	.21	.10	.11	.14
1978	.11	.05	.04	.05
Farms which are family or individually owned, %: 1969	67	75	74	75
1978	71	76	80	80
Change in percent of farms family or individually owned, '69-'78	+4.6	+1.4	+5.6	+4.6
Full owner-operated farms, %, '69	45	35	37	30
Same, '78	38	31	32	28
Change in percent of farms operated by full owners,'69-'78	-7.7	-4.1	-4.1	-2.2
Number of cases	(84)	(33)	(72)	(45)

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* Means of county means.

** The Consumer Price Index was .562 in 1969 when 1978 was placed at 100.

growth in hired labor, and a growth in part ownership at the expense of full ownership. On the other hand, the proportion of farms that are family or individually operated (in contrast to those that are partnerships,corporations, trusts, or other juridical forms) has increased notably. While use of hired labor is growing (from an average of one in three farms having a season-long hired worker to about one in two farms), capital investment in machinery and equipment is growing much more rapidly, as indicated by changes in the ratio of expenditures for hired and contract labor to value of machinery and equipment (see Table 6).

Farm operators in livestock counties are much less likely to consider their principal occupation to be farming than are operators in the three other types of counties. (That variable was not collected in 1969, so change could not be measured.) Likewise, livestock-county operators are more likely to work off the farm 100 or more days per year and their rate of increase in off-farm employment is greater than for the other types. Livestock counties are somewhat less likely to have family or individually owned farms, although they are more likely to be operated by full owners.

D. Analysis of Change of Medium and Large Farms Within Farming System Types

1. Introduction

Goldschmidt attempted to measure the impact of farm size on community and family well-being, while controlling for most other relevant factors, including total agricultural product and size of the community, centrality, and ethnicity (1978: 289-90, 304, 321). However, as Hayes and Olmstead (1984) point out, there were numerous dissimilarities in the communities that could lead to both differences in farm size and differences in community quality. Goldschmidt was unable to control for farming system, a definite intervening factor, since particular farming systems lend themselves to particular labor patterns and, hence, to difference in dominant farm size, as we have noted in our examination of the four farming systems.

Our study seeks to overcome that limitation imposed by the case study method by analyzing census data for a large enough number of counties so we can examine the impact of change in farm size within farming systems types. Nationwide, the period of the 1970s and 1980s has been characterized by a new phenomenon--a bifurcation in the size of agricultural holdings. Medium-sized farms have been decreasing in number and acreage, while very large and very small farms have been increasing, although in the region under study the absolute acreage increase and the farm sales represented by small farms is inconsequential relative to the medium and large farms (see Table 7). Thus, although the percentage growth in small farms is quite substantial, the 1969 base from which that percentage is calculated is quite small (see Table 8). While the number of very large farms is also not great, particularly in the case of mixed crops/livestock counties, it still represents a substantial proportion of total acreage. Since in the region we are studying, the growing number of small farms makes little contribution to either total farm acreage or production, and only moderately greater contribution to total farm numbers, their impact on, or relation to, community structure and well-being was not analyzed. However, for the mixed crop/livestock systems, small residential farms may make a positive contribution to community vitality.

Table 7. FARM SIZE CHANGES IN AGRICULTURAL COUNTIES
CLASSIFIED BY PREDOMINANT FARMING SYSTEMS,
GREAT PLAINS AND WESTERN U.S., 1969-78

Farm Size Variables (1969-78)	Livestock	Wheat	Wheat-Livestock	Mixed Crop-Livestock
Percent change in number of --	(mean scores*)			
farms less then 10 acres	-11 (70)	+3.0 (31)	-1.0 (69)	+2.4 (43)
farms of 10-49 acres	+19 (55)	+28 (22)	+15 (61)	+11 (38)
farms of 50-179 acres	+10 (71)	+14 (30)	+13 (71)	+11 (45)
farms of 180-499 acres	- 8 (80)	- 7 (33)	- 9 (72)	-15 (45)
farms of 500-999	- 4 (82)	-20 (33)	-20 (72)	-20 (45)
farms of 1000-1999	- 0.5 (79)	- 6 (33)	- 5 (72)	+ 0.2 (45)
farms of 2000+	+ 0.4 (81)	+24 (33)	+29 (72)	+29 (41)
Total number of counties in sample	(84)	(33)	(72)	(45)

* Means of county means.

Note: The numbers in parentheses indicate the number of counties with more than 5 farms in the denominator; that is, missing data is due to there being five or fewer farms in that size category in 1969.

2. Relation of percent of farmland in medium and large farms to relevant variables

To understand the accumulated history of the relationship between farm size and various population, community, socioeconomic, and farm variables, we examined the zero-order correlations between percent of farmland in medium and large farms in 1969 and the relevant variables for the same time period. We also looked at the relationship of those two farm size variables to subsequent change in the other variables. Percent of land in farms of 500-999 acres was chosen to represent medium-sized farms and percent of land in farms of 2000+ acres was chosen to represent large farms.[2] The two farm-size variables

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[2] Data were analyzed for counties by sales and size categories for 1969, 1978 and 1982. Because farming system was controlled, farm size proved to

TABLE 8. PERCENTAGE OF FARMS BY FARM SIZE IN AGRICULTURAL COUNTIES
CLASSIFIED BY PREDOMINANT FARMING SYSTEMS,
GREAT PLAINS AND WESTERN U.S., 1969

Farm Size Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop-Livestock
	-- % of farms in each size category —			
farms of less than 10 acres	4.7 (4.7)	2.6 (2.6)	3.9 (3.9)	11.9 (11.9)
farms of 10-49 acres	8.8 (4.1)	4.3 (1.7)	6.4 (2.5)	14.5 (2.6)
farms of 50-179 acres	24.6 (15.8)	11.3 (7.0)	17.7 (11.3)	25.5 (11.0)
farms of 180-499 acres	49.0 (24.4)	31.3 (20.0)	40.1 (22.4)	49.4 (23.9)
farms of 500-999	67.7 (18.7)	59.8 (28.5)	66.1 (26.0)	73.1 (23.7)
farms of 1000-1999	81.2 (13.5)	84.6 (24.8)	87.0 (20.9)	90.8 (17.7)
farms of 2000+	99.9 (18.7)	99.9 (15.3)	99.9 (12.9)	99.9 (9.1)
Number of counties	(84)	(33)	(72)	(45)

Note: The first figure is the cumulative percentage. The figure below it in parentheses is the percentage for that particular size category.

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be a good over-time equivalent of farm sales category. For each type of county, number of farms in each sales category was correlated with number of farms in each size category, utilizing 1982 census figures. Further, the proportional breakdowns for each type of county were compared and equilibrated in order to create three major structural categories: part time, moderate, and large. Part-time farms were those with less than $20,000 of gross sales in 1982. For the livestock, wheat, and wheat/livestock counties, they were farms of less than 500 acres. For the mixed crops/livestock counties, they were farms of less than 180 acres. These farms were assumed to depend on an outside income for family survival. Moderate-sized farms were those with 1982 sales of from $20,000 to $100,000. For the livestock, wheat, and wheat/livestock counties, they were between 500 and 1,999 acres. For the mixed crops/livestock counties, they were between 180 and 999 acres. These farms could be farmed with only family labor. Income might be supplemented by temporary off-farm labor, but the farm operator did not generally hold a permanent off-farm job. Little or no hired labor was used. Large farms had sales over $100,000 and were over 2,000 acres in the livestock, wheat, and were correlated highly negatively with one another. The correlations for the four types of counties range from -.93 to -.98.

As expected, counties in which medium-sized farms predominated over large farms had considerably larger populations (see Table 9). The greater population base of counties with a predominance of land in medium farms over large farms is due mostly to more intensive agriculture in the medium-farm counties and is associated with the ecological potential of agricultural land. The medium-farm counties had a larger proportion of their population living on farms than did the large-farm counties.

Within each farming systems category, the medium-farm counties in the 1970s experienced greater loss in total population than did the large-farm counties. For the medium-farm wheat counties, loss in total population was due largely to a loss in rural farm population.

The medium-farm counties tended to have somewhat younger farm operators than the large-farm counties in all county types except the wheat/livestock counties, and age difference between the two types of counties increased in the decade of the 1970s.

Table 10 shows the relationship between percent of land in medium and large holdings and various measures of integration of agriculture into the modern industrial-type economy. As one would expect, there is a strong positive relation between use of season-long hired labor and large-farm agriculture. However, those counties dominated by medium-sized farms in 1969 experienced a greater increase in hired labor than did the large-farm counties (except in the case of the wheat counties). That is at least partially explained by the fact that middle-sized farms showed the greatest decline in numbers over the 1970s decade. Hence, many of the counties that in 1969 were medium-farm dominated became large-farm dominated, and apparently expanded their use of hired labor.

A high ratio of hired and contract labor to machinery and equipment was strongly associated with large-farm counties in 1969; the gap widened over the succeeding decade, suggesting that growth in machinery purchased in the medium-farm counties during the 1970s was greater than in the large-farm counties. Thus, while the medium-farm counties experienced a more rapid increase in hired labor than the large-farm counties, their increase in mechanization investment was even faster relative to the large-farm counties. Mechanization was the key to the decline in numbers of medium-sized farms and their replacement by large farms. It would appear that medium-farm counties in 1969 lagged behind large-farm counties in the adjustment of farm size to the scale of machinery then available. In the 1970s, that adjustment was made.

In 1969, medium-farm counties had a slightly larger percentage of farms that were individually or family owned than did large-farm counties; that difference increased considerably over the following decade as owners of

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wheat/livestock counties. In the mixed crops/livestock counties, they were over 1,000 acres. These farms did not depend on off-farm income, and often hired labor at peak labor demand periods, either directly or through hiring custom work.

TABLE 9. ZERO-ORDER CORRELATIONS OF PERCENT OF FARMLAND IN MEDIUM FARMS IN 1969 BY POPULATION CHARACTERISTICS OF AGRICULTURAL COUNTIES CLASSIFIED ACCORDING TO PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1969-80

Population Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop Livestock
	— % of land in medium farms — (Pearsonian R)			
Total county population, '70	.35*	.25	.62*	.15
Percent change in total population, '70-'80	-.13	-.17	-.25*	-.30*
Rural farm population as % of total population, '70	.28*	.41*	-.10	.31*
Percent change in rural farm population, '70-'80	-.17	-.40*	-.22	-.21
Average age of farm operators, 69	-.21*	-.17	.16	-.05
Change in average age of farm operators, '69-'78	-.18	-.59*	-.15	-.14
Number of cases	(84)	(33)	(72)	(45)

* Significant at the .05 level.

Note: The correlations between percentage of land in large farms (2000 or more acres) and the variables in the table above are of approximately the same magnitude and of opposite sign from the correlations presented between percentage of land in medium sized farms (500-999 acres) and the same variables, since the two land size variables are correlated nearly perfectly negatively with one another. The correlations between the two land variables are as follows:

Livestock counties	-.93
Wheat counties	-.97
Wheat-livestock counties	-.98
Mixed crop-livestock counties	-.94

larger farms apparently used incorporation as a management and intergenerational transfer tool. For full owner-operated farms, the pattern was different. In 1969, medium-farm counties had a greater percentage of full owner-operated farms than the large-farm counties (except for wheat/livestock counties). During the decade of the seventies, the proportion of full owner-operated farms increased more rapidly in the large-farm counties, especially

TABLE 10. ZERO-ORDER CORRELATIONS OF PERCENT OF FARMLAND IN MEDIUM FARMS IN 1969 BY INTEGRATION OF FARMING INTO THE MODERN ECONOMY, AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1969-78

Modern Economy Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
	(Pearsonian R)			
Number of workers working 150+ days on farm/number of farms, '69	-.49*	-.60*	-.60*	-.73*
Percent change in number of workers working 150+ days/year, '69-'78	.46* (N=84)	-.16	.24*	.35*
Expend. hired & contract labor/value of machinery and equipment, '69	-.50*	-.44*	-.35*	-.75*
Change in expend. for hired & contract labor/value machinery & equipment, '69-'78	-.37*	-.11	-.29*	-.73*
Farms which are family or individually owned, %, '69	.23*	.10	-.02	.24
Change in percent of farms family or individually owned, '69-'78	.37*	.72*	.48*	.04
Full owner-operated farms, %, '69	.07	.30	-.13	.29
Change in percent of farms operated by full owners, '69-'78	-.13	-.59*	-.22	-.18
Number of cases	(84)	(33)	(72)	(45)

* Significant at the .05 level.
Note: see note to Table 9.

in the wheat counties. This may indicate a slightly greater tendency for farmers of larger operations (especially those in wheat counties) to use land purchases as a hedge against inflation. Their greater equity probably allowed them to borrow more money for land purchase. While in medium-farm counties, farmers invested principally in machinery and perhaps rented more land, in large-farm counties they tended to invest in more land, perhaps that which they were already renting.

Table 11 shows that, within each county type, there was a positive association between proportion of land in medium-sized farms and number of retail and wholesale establishments. The more intensive use of the land and the resulting larger population supported by agriculture in the medium-farm counties than in the large-farm counties supported greater trade. There was

TABLE 11. ZERO-ORDER CORRELATIONS OF PERCENT OF FARMLAND IN MEDIUM FARMS IN 1969 BY COMMUNITY-RELATED CHARACTERISTICS OF AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1967-77

Community Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
	-- % of land in medium farms -- (Pearsonian R)			
Retail establishments, #, '67	.35*	.33	.64*	.15
Percent change in number of retail establishments, 1967-77	-.28*	-.23	-.31*	-.01
Percent change in retail sales volume, 1967-77	-.23*	-.08	-.23	-.20
Wholesale establishments, #, '67	.47*	.32	.61*	.14
Wholesale sales per capita, '67	-.26*	-.04	-.03	-.07
Number of cases	(84)	(33)	(72)	(45)

* Significant at the .05 level.

Note: see note to Table 9.

no association between predominant farm size and per capita retail or wholesale sales, except that proportion of land in large farms was positively associated with per capita wholesale sales in livestock counties. Counties with a high proportion of land in medium-sized farms in 1969 experienced a greater decline in wholesale and retail establishments and sales (and, as we saw above, in population) in the succeeding decade than did the counties with a high proportion of land in large farms. This is probably because medium-farm counties experienced more rapid growth in farm size than did the large-farm counties over the decade of the 1970s.

We will now examine the association between farm size and socioeconomic status. Median family income was positively associated with land in large farms and negatively associated with land in medium farms in 1969 (see Table 12). The relation was not strong, except in the case of wheat counties. In the wheat counties, the relationship with change in median income was nearly as strong but reversed; that is, the gap in median family incomes between medium and large-farm counties tended to close. Again, this may be due in part to the fact that many medium-farm counties subsequently became large-farm counties, but rarely did the reverse occur.

Consistent with the pattern for median family income, wheat counties showed a positive association between poverty and percent of medium-farm and a negative one for the large-farm counties. The medium-farm counties showed a greater decline in the poverty level than the large-farm counties in the succeeding decade. The situation for wheat/livestock counties was different. Percent of large farms was significantly more highly correlated with poverty than percent of medium farms in 1969; the gap widened in the succeeding decade. For the other two types of counties, dominant size of farm was unrelated to poverty.

With respect to housing stock built before 1940, percent of land in medium farms was more highly correlated to percent older housing than percent of land in large farms for all county types. Only in the case of wheat/livestock counties did that relationship strengthen during the 1970s.

3. Change in numbers of moderate and large farms related to change in community variables, 1970-80

TABLE 12. ZERO-ORDER CORRELATIONS OF PERCENT OF FARMLAND IN MEDIUM FARMS IN 1969 BY SOCIOECONOMIC CHARACTERISTICS OF THE POPULATION IN AGRICULTURAL COUNTIES CLASSIFIED BY PREDOMINANT FARMING SYSTEMS, GREAT PLAINS AND WESTERN U.S., 1969-1980

Socioeconomic Variables	Livestock	Wheat	Wheat-Livestock	Mixed Crop & Livestock
	-- % of land in medium farms -- (Pearsonian R)			
Median family income, '69	-.19	-.61*	-.15	-.30*
Percent change in median family income, 1969-79	-.04	.45*	.19	.00
Percent families below poverty, '69	.04	.40*	-.23	.07
Change in percent of families in poverty, 1969-79	.05	-.24	-.23*	.11
Percent year-round housing built before 1940, '70	.34*	.30	.38*	.64*
Change in percent of pre-1940 year-round housing, '70-'80	.15	-.01	.39*	.11
Number of cases	(84)	(33)	(72)	(45)

* Significant at the .05 level.
Note: see note at bottom of Table 9.

We chose to analyze the relationship between change in numbers of large and medium farms, on the one hand, and change in variables that indicate community vitality, individual or family well-being, and other farm characteristis, on the other. The time period over which the two sets of variables were measured was approximately the same for both independent and dependent variables. No lag time was allowed for. It was assumed that response was immediate. We called the change in numbers of medium or large farms the independent variables, and, in general, assumed them to be causal. Where it appears that the direction of causality could be reversed, this will be discussed. The initial value (i.e., around 1970) of the dependent change variable was included as an independent control variable.

We hypothesize that the growth in numbers of medium-sized farms (or usually more correctly the lesser decline in numbers of medium-sized farms) had a higher association with positive changes in community vitality and family well-being than did growth in the number of large farms. We chose a linear regression model. We tested whether there was a significant difference in the slopes of the two regression lines for percent change in numbers of medium and large farms each regressed against a particular dependent variable, without taking into account the predominant farming system type. We also tested the relationships among counties of each type to determine if there was significantly different behavior by county type. In general, there was not. The livestock counties were significantly different from counties with other dominant farming systems with respect to population change only. The correlation between percentage change in number of medium farms and percentage change in number of large farms ranged between -.08 and -.32 for the four farming systems types. Thus, there was no problem with multicolinearity between these two variables in the regression equation.

The regressions for which there was a significant difference between the slopes of the regression lines relating the dependent variable to changes in each of the two farm size variables are presented in Table 13.

We tested whether medium-sized farming contributes to greater economic vitality of the local community than does large-scale farming by relating percent change in numbers of medium-scale and numbers of large-scale farms to percent change in number of retail establishments and in retail sales volume, on the assumption that diverse retail activities were the best barometer of such economic vitality. The results suggest that growth in numbers of medium-sized farms or a decline in numbers of large farms contributes to local purchases. Both retail activities variables are positively associated with growth (or a lesser decline) in number of medium-sized farms and negatively associated with growth in number of large farms. This is due to a number of factors:

1) Medium-sized farms have a higher labor-to-capital ratio and use more labor per unit of agricultural product than do large farms, if family labor is counted. Table 13 provides mild support for the idea that growth in medium-sized farms is associated with a more rapid increase in expenditures for hired labor than in investment in machinery and equipment. (See the third equation in Table 13.) That is, medium-sized farms retard the substitution of labor by capital-- contributing to community population retention.

2) Medium-sized farmers tend to buy locally, while large-scale farmers may buy in bulk, bypassing the local community.

TABLE 13. REGRESSIONS OF LINEAR RELATIONSHIP BETWEEN "PERCENT CHANGE IN NUMBER OF LARGE OR MEDIUM FARM" BY POPULATION, LABOR FORCE, COMMUNITY, AND LAND OWNERSHIP CHANGE VARIABLES, AGRICULTURAL COUNTIES IN GREAT PLAINS AND WESTERN UNITED STATES

Change Variables	Slope estimate & Standard error	Significance levels	F value--* $H_o:B_3=B_6$
1. % change in # of retail establishments, '67-'77:			
Medium farms (X3)	+.116 + .051	.025	7.45 (Sig. level = .007)
Large farms (X6)	-.029 + .033	.39	
# retail estab., 1967	-.039 + .023	.10	
R^2	.056		
F value	4.38	.005	
2. % change in retail sales volume, '67-'77:			
Medium farms	+.507 + .183	.006	16.22 (Sig. level = .0001)
Large farms	-.238 + .111	.033	
Retail sales vol, '67	+.0003 + .0006	.61	
R^2	.077		
F value	5.71	.001	
3. Change in ratio of expend. for hired & contract labor to machinery & equipment value, '69-'78			
Medium farms	+.0003 + .0001	.008	6.99 (Sig. level = .009)
Large farms	-.00002 + .00006	.81	
Labor expend/machinery & equip. value, '69	-.41 + .03	.0001	
R^2	.47		
F value	61.8	.0001	
4. % change in rural non-farm population, '70-'80:			
Medium farms	+.145 + .090	.11	6.56 (Sig. level = .011)
Large farms	-.087 + .056	.12	
Rur. non-farm pop., 70	-.0015+ .0007	.05	
R^2	.046		
F value	3.55	.015	
5. % change in total population, '70-'80:			
Medium farms	+.190 + .044	.0001	33.56 (Sig. level = .0001)
Large farms	-.072 + .028	.011	
Total pop., '70	+.0006+ .0003	.026	
R^2	.137		
F value	11.60	.0001	

(Table 13 is continued on next page.)

(Table 13, continued)

6. Change in % of housing built before 1940, '70-'80:			
Medium farms	-.049 + .014	.001	24.08 (Sig. level = .0001)
Large farms	+.022 + .009	.014	
% pre-1940 housing, '70	-.053 + .024	.030	
R^2	.104		
F value	8.49	.0001	
7. Change in % of farms with full owners, '69-'78:			
Medium farms	+.038 + .016	.019	9.11 (Sig. level = .003)
Large farms	-.010 + .009	.25	
% full-owner farms, '69	-.43 + .03	.0001	
R^2	.51		
F value	71.5	.0001	

Note: Regressions numbered 1, 2, 4, 5, and 6 are based on 223 cases; regressions 3 and 7 are based on 209 cases; cases in which the number of medium or large farms was 5 or less in 1969 were omitted from the analysis.

*This is a test of the difference in slope of X3 and X6 (Percent change in number of medium and large farms, respectively). As can be seen, the differences are significant in all cases. Medium farms are defined as those between 500 and 999 acres; large farms are those with 2000 or more acres.

3) Counties with growth in large farms are more likely to have absentee farm operators or ones who do much of their consumer purchasing and recreating outside the county.

Retail trade appears to be much more sensitive to farm size change than wholesale establishments.

Farm size change was also related to population change. One would expect that the greatest impact of farm size change would be on rural farm population. If medium-sized farms use more labor (on a per acre or per unit of product basis) than do large scale farms, one would expect that the rural farm population would increase with a growth in medium-sized farms and decrease with a growth in large farms. Surprisingly, we found no significant relationship between the farm size change variables and change in rural farm population. Rural farm population continued to decline regardless of the type of change in farm structure. However, there was an important impact on the rural nonfarm population, the largest population category in most of the counties. Since in many rural counties the largest town is rural (i.e., less than 2,500 population), the results presented in Table 13 provide support for the idea that growth in medium-sized farms contributes to the development of associated economic activities centered in rural towns, while growth in large-sized farms has the opposite effect. The impact of farm structural change on total population of the county follows the same pattern and the relationships are even stronger (Regressions 4 and 5 of Table 13).

The relationship between change in number of medium farms and change in the two population variables is even stronger when the livestock counties are excluded, since for the livestock counties there is no significant relationship between the population variables and change in medium-sized farms. As suggested earlier, the livestock counties had bottomed out in their population decline by 1970 (see Table 3). The agricultural sector has little impact on the population of extensive livestock counties, since livestock production makes little contribution to the general economy of such counties.

Although economic vitality of the rural community is enhanced by the growth of medium-sized farms and diminished by the growth of large farms, it is very possible that the outmigration pursuant to the growth of large farms and the greater product per farm on large farms would bring about higher incomes for those remaining in such agricultural counties. The farming systems we are dealing with require much less hired labor than do the industrial farming systems described by Goldschmidt; although during the decade of the 1970s there was a general increase in hired labor in all four farming systems under consideration (Table 6). Three measures of family welfare were available to us--median family income, percent of families in poverty, and percent of year-round housing constructed prior to 1940. We found no significant relationship between change in numbers of medium or large farms and the first two welfare variables. Median family income in agricultural counties is so dependent on cyclical changes in the agricultural economy that it is an unreliable variable. Percent of families below poverty is a more stable measure, perhaps because none of the counties in our sample were counties with high levels of poverty (none was classified as poverty counties under the USDA classification system we are utilizing). Percent of housing built before 1940, is a more stable indicator of standard of living than is median family income. We did find a relationship between charge in percent of pre-1940 housing and change in numbers of medium and large farms (see regression number 6 in Table 13). This would suggest that general economic vitality based on moderate-sized farming contributes in a very limited way to improved standard of living.

Maintenance of medium-farm agriculture contributed slightly to an increase in full ownership of farms (regression 7, Table 13). Full ownership was achieved at the expense of partial ownership, not tenancy. There was no relationship between change in tenancy and change in numbers of medium or large farms.

These results are consistent with those obtained by Goldschmidt 40 years ago. We have resolved his principal methodological problems and extended his conclusions beyond the industrial agriculture zone of the Central Valley of California to commercial family farm agriculture of the Great Plains and West. Where, because of his case study approach, Goldschmidt was unable to control for type of farming system and for the related problem of differences in age of the two communities (Hayes and Olmstead, 1984), we were able to do so through the use of macrostructural secondary analysis. The patterns of relationship were quite similar for all four farming systems types (with the partial exception of livestock counties). The farming systems analyzed, although covering a major part of the United States, are more similar to each other than to the orchard system in Dinuba and the row crop system in Arvin.

III. Public Policy, Agricultural Structure and the Rural Community

Macro policies, particularly fiscal and monetary policies, affected the structure of agriculture in the rural, agriculturally based counties in the region studied more than did agricultural policies. Monetary and fiscal policy, which lowered the factor price of capital and inflated the price of land, led to a cycle of investment in agriculture for speculative and tax purposes, rather than for productive purposes, driving up the price of land beyond its potential productive return. Increasing equity in turn provided farmers with the collateral they needed to borrow more money to buy more land -- all the while bidding against urban investors seeking tax shelters and "inflation-proof" investments. Particularly in the area under study, where labor inputs are low relative to land, the push to expand resulted from efforts to reduce tax liability and to hedge against inflation in a situation of high inflation and high nominal interest rates, rather than direct economies of scale provided by the ever-larger machinery purchased (and quickly depreciated) to farm ever-larger parcels of land.

This is not to say the grain farmers in the area were not influenced by the changing farm programs. The removal of acreage limitations in the mid-1970s brought competing lands into grain production not only in the region analysed but in other parts of the country as well. This certainly had a negative impact on grain prices (and may have slightly helped the livestock sector).

The principal impact of technology has been in the adoption of machinery, which has been associated with the expansion of what were initially medium-sized farms. It appears that farms that were over 2,000 acres in 1970 did not grow in size as rapidly as did moderate-sized farms of 500-999 acres.

It is the thesis of this analysis that policy, rather than technology, can account for most of the shift in agricultural structure in the region. However, a major production technology, irrigation, has slowed the growth in farm size in the mixed crop livestock areas. Some of the changing technology in beef production has also favored moderate and large-sized farms equally, since a very small proportion of both groups applied such techniques as artificial insemination and induced estrus (Gilliam, 1984: 17-18). Although the introduction of large-scale machinery in grain production certainly hastened the consolidation of farms, the increased use of that machinery must be evaluated in the light of the fiscal policies that made its purchase profitable beyond the labor saving or other efficiencies it provided. Only cheap credit coupled with substantial tax savings on interest and investment tax credits can justify such major capital investments which led to further need for capital in order to expand land holdings to make the investment in machinery appear to be efficient.

The effects of tax policies allowing large write-offs against nonfarm income and a short holding period on farm property for capital gains exemption has been to favor operators of large and small farms who are in farming as an investment; for them, in contrast to full-time operators of moderate-sized farms, production is secondary.

Eginton (1980) suggests that federal fiscal-monetary policy may have contributed to growth in size and declining numbers of farms by encouraging the substitution of capital for labor. Those policies have been fairly consistent in their thrust since the 1930s, and have been based on the assumption of high factor costs of labor relative to capital.

Both fiscal and monetary policies have recently undergone substantial changes, including the relative factor prices of land, labor, and capital. Ironically, those changes seem to have increased the trend to large farms in the area under study, further disadvantaging rural agricultural communities. Monetary policy changed dramatically in 1979, with sharp control over the money supply motivated by a strong desire by the Federal Reserve Board to control inflation. Fiscal policy changed in 1981, with the Reagan administration's tax cut coupled with large spending increases, particularly for the military, resulting in a large federal deficit and increased federal borrowing. In combination, these policies have resulted in a decline in inflation, an increase in real interest rates leading to the first dramatic shift in factor prices in 50 years, declining land values, a strong dollar, and decreasing export competitiveness.

These policies have particularly dramatic impacts on wheat farmers in the region, with substantial, although lesser impacts on the other farming systems types as well. Farmers in the regions analyzed use many times more credit than other sectors of the population. Because of dependence on the seasonal sale of wheat and calves (in contrast to such commodities as milk, poultry, and hogs marketing of which can occur year round), short-term credit is particularly important for these farmers. This is compounded because of the relatively high dependence on farming as the primary income in these areas, and the lack of alternative sources of capital.

The decline in export markets has been particularly disadvantageous for wheat farmers. During the 1970s, wheat changed from a primarily domestically consumed to a primarily exported crop. The heavy dependence on export markets, when farm products are overpriced not because of inefficiency but because of exchange rates totally beyond the control of the farm sector, is particularly disadvantageous to the communities in the wheat, wheat/livestock, and mixed crops/livestock counties under study. Within these counties, the increasing cost of capital has the strongest implications for the moderate-sized farms, which have less diversified income sources or credit access than do either part-time or large farms.

Agricultural policies have direct impact through commodity programs for all but the livestock operations. These programs, which have had the dual purpose over the years of stabilizing commodity supply and underwriting farm incomes, have an impact on the structure of agriculture and rural communities. The support price and loan price for wheat are particularly important, as are various measures for production limitation.

Historically, price support programs have benefitted large farms more than smaller farms growing a particular commodity. For large farms, hired labor is a larger portion (and the owner's labor a smaller portion) of total inputs than is true for medium or small farms. As Schultze points out, "Much of the small farmer's input is his own labor, the return to which is treated not as an expense but as part of income" (1971: 17). Small and medium farms are more likely to substitute family labor for capital. Since price supports raise prices and receipts about the same percentage above free market levels for both groups, price supports will increase large farms' net income by a greater percentage than the income of medium and small farms. Placing of ceilings on total subsidy payments to a particular individual or farm has been a response to that problem. Ceilings provide no incentives for operators of large farms to reduce acreage, thereby limiting the ability of the government to encourage production reductions during times of overproduction--particularly as more of total production comes from large farms. A more appropriate approach would be progressive graduated rates of subsidy payments (per bushel or per acre), which diminish as total production of the commodity increases. By reducing total production, this approach would shift some of the costs of farm programs from the treasury to consumers, and would increase the advantages to medium farms rather than large farms. Coupled with a devaluing dollar vis-a-vis foreign currency (dependent on tax reform and cutting the federal budget deficit), such a rise in commodity prices should not seriously decrease U.S. competitiveness in the agricultural export market.

Research in the rice industry (Grant, et al., 1984) demonstrates that the shift from a farm policy of supply control to more variable economic conditions and a market-oriented farm policy resulted in increasing price variability. The shift in the 1970s to a target price program emphasized deficiency payments as a means of income support to producers. The focus on income support rather than supply control was an enormous stimulus to production. Grant, et al. calculate that if the farm programs of the sixties had continued to the present, rice prices would have restabilized after the 1972-74 rise in world grain prices. In contrast, the policies instituted increased production of grains. For rice, it resulted in increasing price variability, with the profits from that variation accruing not to growers but to rice millers and marketers. Similar siphoning off of profits from price fluctuations from wheat farmers can be postulated. Morton et al., using a simulation model, estimated a 50 percent greater instability in wheat prices with elimination of commodity programs as compared to the 1977-80 period (1984: 90). Grant, et al., show that grain price variability is particularly disadvantageous for part owners and tenants. This group could be translated into operators of moderate-sized farms in the farming systems under examination in this paper. Interest costs, credit availability rules, and income tax schedules have resulted in high average leveraging (debt/equity) ratios for these farmers.

In the counties under consideration, some part owners moved into full owner positions during the late seventies. This tended to occur in counties where the number of moderate-sized farms increased, or decreased only modestly. Moving into the full owner category greatly increased their financial vulnerabilty. As Grant et al. demonstrate, there were considerable benefits in land ownership in the 1970s for rice farmers, and, by extension, other grain farmers. In part, that was due to credit whose real interest rates for farmers was less than the rate of inflation. However, the radical change in the cost of credit, coupled with the deflation of the land used as collateral for it, has increased the vulnerability of both moderate and large farms in the region, particularly those engaged in wheat, wheat/livestock, and mixed crops/livestock farming systems.

Reduction or elimination of the commodity programs has implications for the counties under consideration. Grain prices, particularly wheat prices, will seek lower levels and increase in variability. Decreased grain prices in turn will lead to a decrease in the use of inputs such as fertilizers and pesticides. (Farmers in the region have already demonstrated their sensitivity to price variations by decreasing the use of fertilizer in recent years.) This in turn will decrease the numbers of supply dealers in the nearby rural communities. Decreasing and fluctuating grain prices will increase the dualization of farm structure in the wheat, wheat/livestock, and mixed crops/livestock counties. Part-time farming will increase when there are alternative sources of employment available; such employment is generally not available in the agriculturally dependent counties of the region. Large farms will increase, with more of the labor hired on a custom basis. This does not increase the use of permanent hired labor, but instead could give rise to specialized farm service firms related to management, pest control, fertility control, tillage operations, irrigation, and planting, as well as the more traditional custom services of harvesting and marketing. That shift would allow rural communities to maintain a smaller but more highly-educated middle-class population than would be the case if technology were less specialized and exact. Increasing technological sophistication could be translated into increasing development of specialized farm service businesses in rural communities, providing supplemental employment opportunities for beginning farmers on medium-sized farms.

The mixed crops/livestock counties would be affected somewhat differently by the demise of the commodity programs. The price floor under the grains produced would be removed. However, the feedlot industry that has grown up in many of these counties would profit from reduced grain prices, which could increase the use of local grains, including wheat, as feed. Expanded use of bovine growth hormone and of rumen activators should convince more feedlot owners to substitute sorghum for corn, which must often be imported from the corn belt. Such a new equilibrium could result in more self-sufficient mixed crops/livestock communities. Those counties have been marked by fewer part-time farms in the past, but a decline in commodity programs would increase their number, as farm families seek to diversify income sources and reduce risk.

The livestock counties would be relatively unaffected by a decline in commodity programs. They do, however, profit from relatively firm tariff barriers against imported beef. Policies opening up U.S. markets further to imported meat could further descrease and destabilize beef prices. These policies would have little impact on the part-time livestock farmers. Indeed, such a policy might lead to an increase of part-time cow-calf operations in the region, mirroring the large proportion of very small cow-calf operations in the eastern part of the country.

A major policy affecting cow-calf operations in the western part of the region is the cost of federal grazing permits, which has increased dramatically over the last few years. This heightens the decline of moderate-sized livestock farms, as farm operators with other sources of income, such as absentee landlords and part-time farmers, have the capital available to pay the fees. Tax incentives encourage outside investment in extensive livestock raising, particularly those that make tax-loss farming profitable. It should be remembered that the increasing real cost of capital increases the real cost of grazing fees more than the actual fee increase.

The tax structure is perhaps the major policy area that encourages the growth of a dual farm structure in the region. The current system of rapid depreciation, capital gains exclusions, and investment tax credit encourage short-term capital entry into agriculture in the region. It is important to note that the lack of profitability of farming in the plains and mountain west has resulted in minimal and declining corporate investment. The high capital requirements of this type of agriculture, with the great difference between production time and labor time, mean that, particularly since the factor cost of capital has changed, little long-term investment will be made in such agricultural enterprises.

The tax structure does, however, encourage the entrance of speculative capital, with substantial impact on agricultural structure and on rural communities. Watts et al. (1983) demonstrate the importance of economic incentives provided particularly by the capital gains provisions of the federal tax code in converting rangeland to cropland. The ecological implications of this conversion are negative, with repercussions for the rural community because of the deterioration of the land base through soil erosion. The depleted soil then requires larger and larger farms in order to raise the same number of cattle. Sales do not increase, but farm size does. Increasing dispersal of the rural population has negative implications for rural community vitality and growth. Not only are such dispersed farm families less likely to participate in the governmental functions of the community, but they are more likely to drive to urban centers for their trade needs.

Much of the past analysis done on tax policy was carried out under assumptions of high inflation (Tweeten, 1979, 1980; Melichar, 1979; Eginton, 1980). Under conditions of high inflation, investment in land was the only rational alternative, given high rents, low real interest rates, inflating assets, and, most importantly, interest payment deductions on income tax. These conditions, according to Eginton, accelerated the trend toward fewer and larger farms. A setting of dollar limits to the interest payment write-off would stop subsidizing the growth of large farms. In the more extensive farming systems under examination (wheat, wheat/livestock, and livestock), accelerated depreciation tax benefits had modest impact, except on the conversion of grazing land to crop land. However, in other areas, highly mechanized capital-intensive farms grew at the expense of moderate-sized farms because of the depreciation allowance.

Tax policies that encourage expansion of land holdings over current consumption (such as the tax concessions described above) have implications for rural communities. Not only do such policies discourage the maintenance of moderate-sized farms, but they depress the multiplier effect of farm income in a community. Coupled with the deregulation of banking, which has disproportionately disadvantaged rural banks (Green, 1985), capital flow is increasingly out of rural communities, with the concomitant decline in community well-being. Policies that encourage capital outflow increase community decline.

Many of the problems of rural communities fall on local governments to solve. Increasing capital costs will make provision of schools, medical facilities, streets, roads, water, and sewage facilities more costly for a declining population with assets that are declining in value. Policies that discourage local taxation, such as the proposal to cease allowing local and state taxes to be deducted from federal income tax, will exacerbate community problems.

Policies influencing technology development and availability will have little impact on the wheat, wheat/livestock, and livestock counties. Although many technologies are on the horizon for confined animal raising, the ease of transferring such technology to the low management, extensive animal raising systems of the mountain West and Great Plains is low. The main technology development, which could be greatly enhanced by a concerted public effort at support and development and could aid the maintenance of medium farms, is information technology. Making alternative management techniques available and usable may have a large impact on keeping moderate-sized farmers in business, particularly in the crucial area of marketing. Telemarketing systems are already in place, which allow for the gathering together of small lots of sheep for market in the midwest. Greater ability to pool small lots to achieve the best price would enhance the viability of moderate-sized farms. However, it might require some public support before such a system became self-supporting. Fortunately, such technological development lends itself to small entrepreneurs based in rural communities, much as the growing number of small businesses specializing in pest control and farm management that have emerged. In each of these cases, as with artificial insemination, Cooperative Extension at first provided services later taken over by small firms once their use for local farmers and their financial practicality were established. Minimal public investments could counteract the marketing and management advantages of large farms and also reinforce the small business segement of rural agricultural communities.

In the more capital-intensive agriculture of the mixed crops/livestock counties, the development of electronic sensing and irrigation control mechanisms could extend the available subsurface water supply and provide a continuing mechanism for moderate-sized farms to remain viable by decreasing costs of irrigation. Once again, the development of such technology lends itself to small, locally based enterprises (or at least franchises), increasing the recirculation of capital in rural communities. The adoption of such technology depends on macroeconomic incentives to reduce water usage, such as an increase in natural gas and petroleum costs or strict regulatory legislation, neither of which is on the immediate horizon. The elimination of the water depletion allowance is a policy change that would strengthen medium as against large farms and would maintain viable communities in the area of the Ogallalah aquifer for a longer period of time, since water drawdown would be slower (Center for Rural Affairs, n.d.: 9).

Technologies that increase the efficiency of confined animal operations, particularly feedlots, would also increase the viability of moderate-sized farms, by providing a local market for feed grains and calves, as well as seasonal off-farm employment and capital recirculation within the rural community. The introduction of such technology would not necessarily favor large feedlots over moderate-sized ones. Indeed, inexpensive, computerized, individualized feeding systems could encourage a return to farm-fed cattle on larger farms. Feedlots provide investment alternatives for community professionals, as well as a local market for feed grains.

Other kinds of technology development, such as biological nitrogen fixation in grains, would have the greatest impact in the mixed crops/livestock counties, since corn uses three times as much nitrogen fertilizer as wheat. Public policy support of research that would most benefit moderate-sized farms in the region would be a continuation of maintenance research for grains, focusing on reducing the costs of production as well as reducing risk of production. Yield-related research, as well as research on grain quality, would have less impact on maintaining moderate-sized farms, unless such research were directly linked to forward-contracted market development. Forward contracting could be used by farmers with all sizes of operations to assure a price and help rationalize decision making. A moderate investment in research over time by the public sector could contribute to reducing the cash flow problems of moderate-sized farms (by decreasing the need for purchased inputs) and increasing price stability through linking product development to market. However, this would mean a definite shift from quality-related research, which has tended to assume that a market can be generated around quality, not price, despite the world debt crisis and the strong dollar.

In the short run, the most beneficial agricultural research and extension activities for rural communities would be those that defined appropriate farming practices for the abruptly changed factor prices faced by farmers since 1981. Increased costs of capital suggest a need to shift to fewer inputs and lower energy use in agriculture, and perhaps substituting labor for machinery (or at least slowing the adoption of larger machinery). Since the largest farms also are highly leveraged, such research and extension would benefit large farms as much as medium farms, although medium farms, because they use principally family labor, have greater flexibility in substituting labor for capital. While the reduction in purchased inputs would have a negative impact on local input firms, that impact is being felt anyhow. Prudent farming practices (in conjunction with government programs for interest and/or principal buy-downs for moderately or highly leveraged farmers could contribute to increased farm income and increase retail consumer purchases in rural communities.

The decline of moderate-sized farms, which has occurred in all the farming systems in the region, has been detrimental for community well-being. Policies decreasing tax advantages for short-term investment in agriculture (particularly increasing the holding period for capital gains exemption and stopping the accelerated depreciation tax advantage), and policies setting limits on interest payment write-offs would aid the maintenance of moderate-sized farms. Technological developments to increase the availability of information, particularly regarding markets, would aid rural communities directly by creating local businesses (more sophisticated that the traditional sale barn), as well as aiding the marketing alternatives of moderate-sized farms. Finally, technology aimed at reducing the costs of production and making management more efficient, either through increased information availability or by customizing the service through the creation of locally-based consulting firms, would aid in maintaining medium farms and the vitality of rural agricultural communities in the region.

BIBLIOGRAPHY

Albrecht, Don E., Steve H. Murdock and Howard Ladewig
1984 "Understanding farm structure and demographic change: an ecological approach. Paper presented at the annual meeting of the American Sociological Association, San Antonio, Texas.

Bender, Lloyd D., Bernal L. Green, Thomas F. Hady, John A Kuehn, Marlys K. Nelson, Leon B. Perkinson, and Peggy J. Ross
1985 "The diverse social and economic structure of nonmetropolitan America," Rural Development Research Report No. 49. Washington, D.C.: Agriculture and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture.

Center for Rural Affairs
n.d. "Modified flat tax proposals: their treatment of agriculture and impact on family farm survival and profitability," mimeographed publication, Walthill Nebraska, 9pp.

Eginton, Charles W.
1980 "Impacts of federal tax policies on potential growth in size of typical farms," American Journal of Agricultural Economics (December): 929-939.

Flora, Jan L.,
1986 "History of wheat research at the Kansas Agricultural Experiment Station," in Lawrence Busch and William Lacy. The Agricultural Scientific Enterprise; 1887-1987: a System in Transition. Boulder, Co: Westview Press (forthcoming).

Flora, Jan L., Ivan Brown, and Judith Lee Conboy
1977 "Impact of type of agriculture on class structure, social well-being, and inequality." Presented at the Rural Sociological society meeting, Madision, WI (August).

Gilliam, Henry C., Jr.
1984 "The U.S. beef cow-calf industry," Agricultural Economics Report No. 515. Washington, D.C.: National Economics Division, Economic Research Service, U.S. Department of Agriculture (September), 60pp.

Goldschmidt, Walter
1978 As You Sow. Montclair, N.Y.: Allanheld, Osman and Co.

Grant, W. R., J. W. Richardson, B. W. Brorsen, and M.E. Rister
1984 "Economic impacts of increased price vulnerability: a case study with rice," Agricultural Economics Research 36,4 (Fall): 17-27.

Green, Gary P.
1985 "Technocartic strategies of control: the case of the multibank holding company in rural areas," The Rural Sociologist 5,1 (January): 10-14.

Hayes, Michael N., and Alan L. Olmstead
1984 "Farm size and community quality: Arvin and Dinuba revisited," American Journal of Agricultural Economics 66 (November): 430-436.

Melichar, Emanuel
1979 "Capital gains versus current income in the farming sector." American Journal of Agricultural Economics: 1085-1092.

Pfeffer, Max J.
1983 "Structural origins of three systems of farm production in the United States" Rural Sociology 48(4): 540-562.

Schultze, Charles L.
1971 "The distribution of farm subsidies: who gets the benefits?" a staff paper. Washington, D. C.: The Brookings Institution, 51pp.

Tweeten, Luther
1984 "Causes and consequences of structural change in the farming industry," in Research in Domestic and International Agribusiness Management 5 (Greenwich, Conn: JAI Press): 27-106.

Van Arsdall, Roy N., and Kenneth E. Nelson
1983 "Characteristics of farmer cattle feeding," Agricultural Economics Report No. 503. National Economics Division. Economic Research Service. Washington, D.C.: U.S. Department of Agriculture (August), 41pp.

Watts, Myles J., Lloyd D. Bender, and James B. Johnson
1983 "Economic incentives for converting rangeland to cropland," Cooperative Extension Service Bulletin 1302. Bozeman: Montana State University (November), 26pp.

APPENDIX

List of Agriculturally-Dependent Counties in Study

Livestock Counties

FIPS Code	County and State	FIPS Code	County and State
8011	Bent, CO	46017	Buffalo, SD
8025	Crowley, CO	46023	Charles Mix, SD
8027	Custer, CO	46043	Douglas, SD
8087	Morgan, CO	46061	Hanson, SD
16037	Custer, ID	46063	Harding, SD
20127	Morris, KS	46073	Jerauld, SD
20171	Scott, KS	46089	McPherson, SD
20197	Wabaunsee, KS	46111	Sanborn, SD
30011	Carter, MT	46121	Todd, SD
30033	Garfield, MT	48009	Archer, TX
30037	Golden Valley, MT	48035	Bosque, TX
30039	Granite, MT	48063	Camp, TX
30057	Madison, MT	48081	Coke, TX
30059	Meagher, MT	48117	Deaf Smith, TX
30069	Petroleum, MT	48129	Donley, TX
30075	Powder River, MT	48137	Edwards, TX
30097	Sweet Grass, MT	48175	Goliad, TX
30103	Treasure, MT	48195	Hansford, TX
30107	Wheatland, MT	48205	Hartley, TX
31005	Arthur, NE	48235	Irion, TX
31009	Blaine, NE	48247	Jim Hogg, TX
31015	Boyd, NE	48269	King, TX
31017	Brown, NE	48271	Kinney, TX
31031	Cherry, NE	48287	Lee, TX
31075	Grant, NE	48313	Madison, TX
31103	Keya Paha, NE	48319	Mason, TX
31113	Logan, NE	48327	Menard, TX
31115	Loup, NE	48333	Mills, TX
31117	McPherson, NE	48359	Oldham, TX
31171	Thomas, NE	48377	Presidio, TX
32027	Pershing, NV	48385	Real, TX
35003	Catron, NM	48393	Roberts, TX
35021	Harding, NM	48413	Schleicher, TX
35033	Mora, NM	48421	Sherman, TX
35057	Torrance, NM	48443	Terrell, TX
35059	Union, NM	48483	Wheeler, TX
40129	Roger Mills, OK	49027	Millard, UT
40139	Texas, OK	49031	Piute, UT
41037	Lake, OR	49033	Rich, UT
41069	Wheeler, OR	49055	Wayne, UT
46003	Aurora, SD	53019	Ferry, WA
46015	Brule, SD	56027	Niobrara, WY

Wheat Counties

FIPS Code	County & State	FIPS Code	County & State
8033	Dolores, CO	38013	Burke, ND
16061	Lewis, ID	38019	Cavalier, ND
27069	Kittson, MN	38023	Divide, ND
27089	Marshall, MN	38031	Foster, ND
30001	Beaverhead, MT	38039	Griggs, ND
30015	Chouteau, MT	38055	McLean, ND
30019	Daniels, MT	38061	Mountrial, ND
30051	Liberty, MT	38063	Nelson, ND
30055	McCone, MT	38075	Renville, ND
30073	Pondera, MT	41021	Gilliam, OR
30091	Sheridan, MT	41049	Morrow, OR
30101	Toole, MT	41055	Sherman, OR
31007	Banner, NE	53013	Columbia, WA
31049	Deuel, NE	53023	Garfield, WA
31105	Kimball, NE	53043	Lincoln, WA
31135	Perkins, NE	53075	Whitman, WA
38009	Bottineau, ND		

Mixed Crop & Livestock Counties

FIPS Code	County & State	FIPS Code	County & State
8009	Baca, CO	31061	Franklin, NE
8125	Yuma, CO	31065	Furnas, NE
20055	Finney, KS	31069	Garden, NE
20057	Ford, KS	31073	Gosper, NE
20067	Grant, KS	31077	Greeley, NE
20069	Gray, KS	31083	Harlan, NE
20081	Haskell, KS	31085	Hayes, NE
20093	Kearny, KS	31087	Hitchcock, NE
20097	Kiowa, KS	31099	Kearney, NE
20119	Meade, KS	31123	Morrill, NE
20129	Morton, KS	31125	Nance, N
20179	Sheridan, KS	31129	Nuckolls, NE
20185	Stafford, KS	31161	Sheridan, NE
29187	Stanton, KS	31181	Webster, NE
20189	Stevens, KS	40025	Cimarron, OK
20193	Thomas, KS	46025	Clark, SD
20199	Wallace, KS	46057	Hamlin, SD
20203	Wichita, KS	46115	Spink, SD
31029	Chase, NE	46119	Sully, SD
31033	Cheyenne, NE	46123	Tripp, SD
31057	Dundy, NE	48011	Armstrong, TX
31059	Fillmore, NE	48145	Falls, TX

Wheat - Livestock Counties

FIPS Code	County & State	FIPS Code	County & State
8063	Kit Carson, CO	38021	Dickey, ND
8073	Lincoln, CO	38025	Dunn, ND
8115	Sedgwick, CO	38027	Eddy, ND
8121	Washington, CO	38033	Golden Valley, ND
16023	Butte, ID	38037	Grant, ND
16041	Franklin, ID	38043	Kidder, ND
20023	Cheyenne, KS	38045	La Moure, ND
20025	Clark, KS	38049	McHenry, ND
20033	Comanche, KS	38053	McKenzie, ND
20039	Decatur, KS	38065	Oliver, ND
20063	Gove, KS	38085	Sioux, ND
20071	Greeley, KS	38087	Slope, ND
20075	Hamilton, KS	40003	Alfalfa, OK
20077	Harper, KS	40007	Beaver, OK
20083	Hodgeman, KS	40033	Cotton, OK
20089	Jewell, KS	40043	Dewey, OK
20095	Kingman, KS	40053	Grant, OK
20101	Lane, KS	40151	Woods, OK
20105	Lincoln, KS	41063	Wallowa, OR
20123	Mitchell, KS	46007	Bennett, SD
20135	Ness, KS	46021	Campbell, SD
20141	Osborne, KS	46037	Day, SD
20143	Ottawa, KS	46041	Dewey, SD
20151	Pratt, KS	46049	Faulk, SD
20153	Rawlins, KS	46055	Haakon, SD
20165	Rush, KS	46059	Hand, SD
20183	Smith, KS	46071	Jackson, SD
20195	Trego, KS	46075	Jones, SD
30007	Broadwater, MT	46085	Lyman, SD
30045	Judith Basin, MT	46091	Marshall, SD
30071	Phillips, MT	46095	Mellette, SD
30079	Prairie, MT	46105	Perkins, SD
30099	Teton, MT	46107	Potter, SD
30109	Wibaux, MT	46137	Ziebach, SD
38001	Adams, ND	48155	Foard, TX
38007	Billings, ND	48447	Throckmorton, TX

FIGURE 1. LIVESTOCK COUNTIES

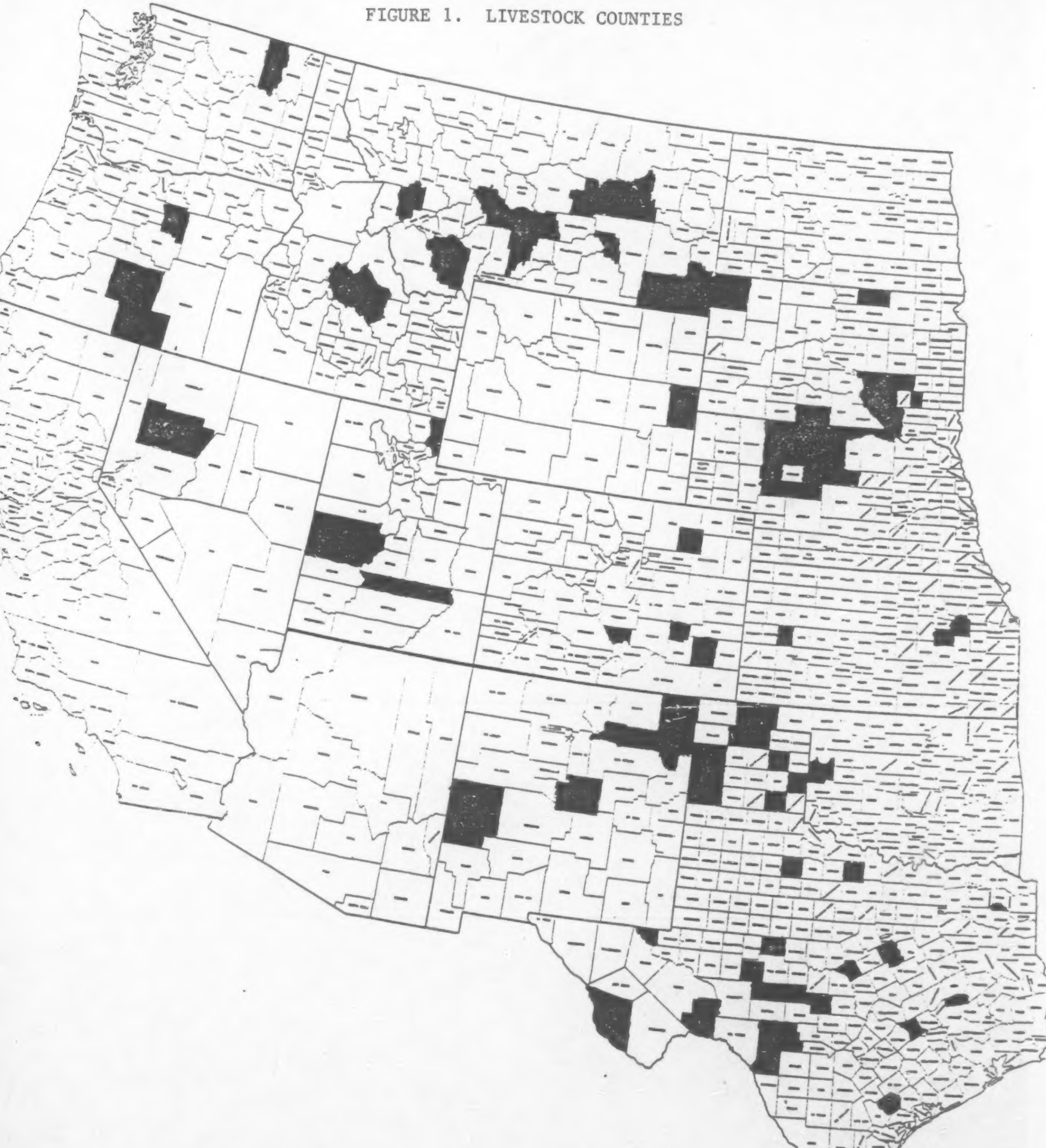


FIGURE 2 WHEAT COUNTIES

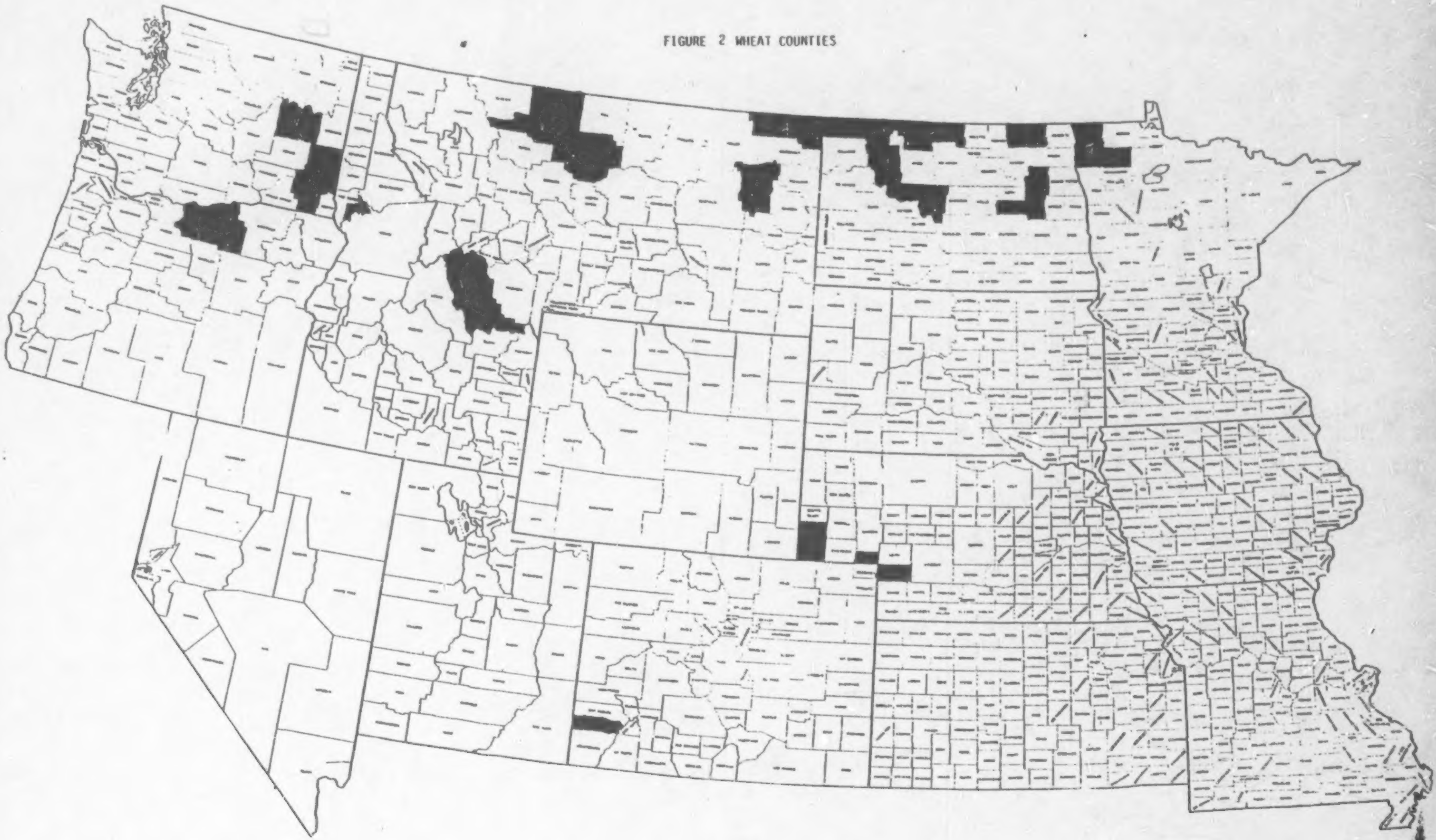


FIGURE 3. WHEAT AND LIVESTOCK COUNTIES

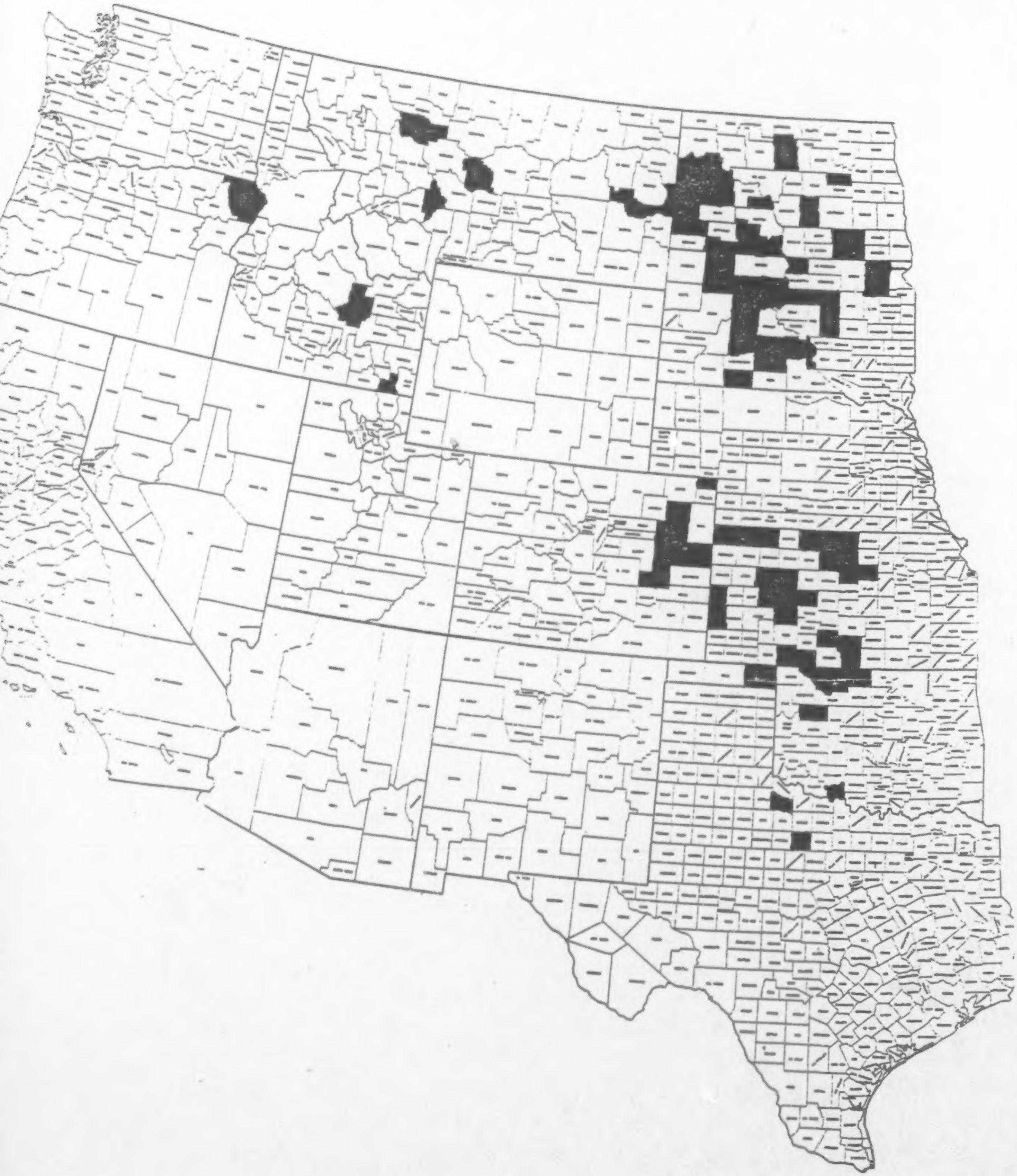
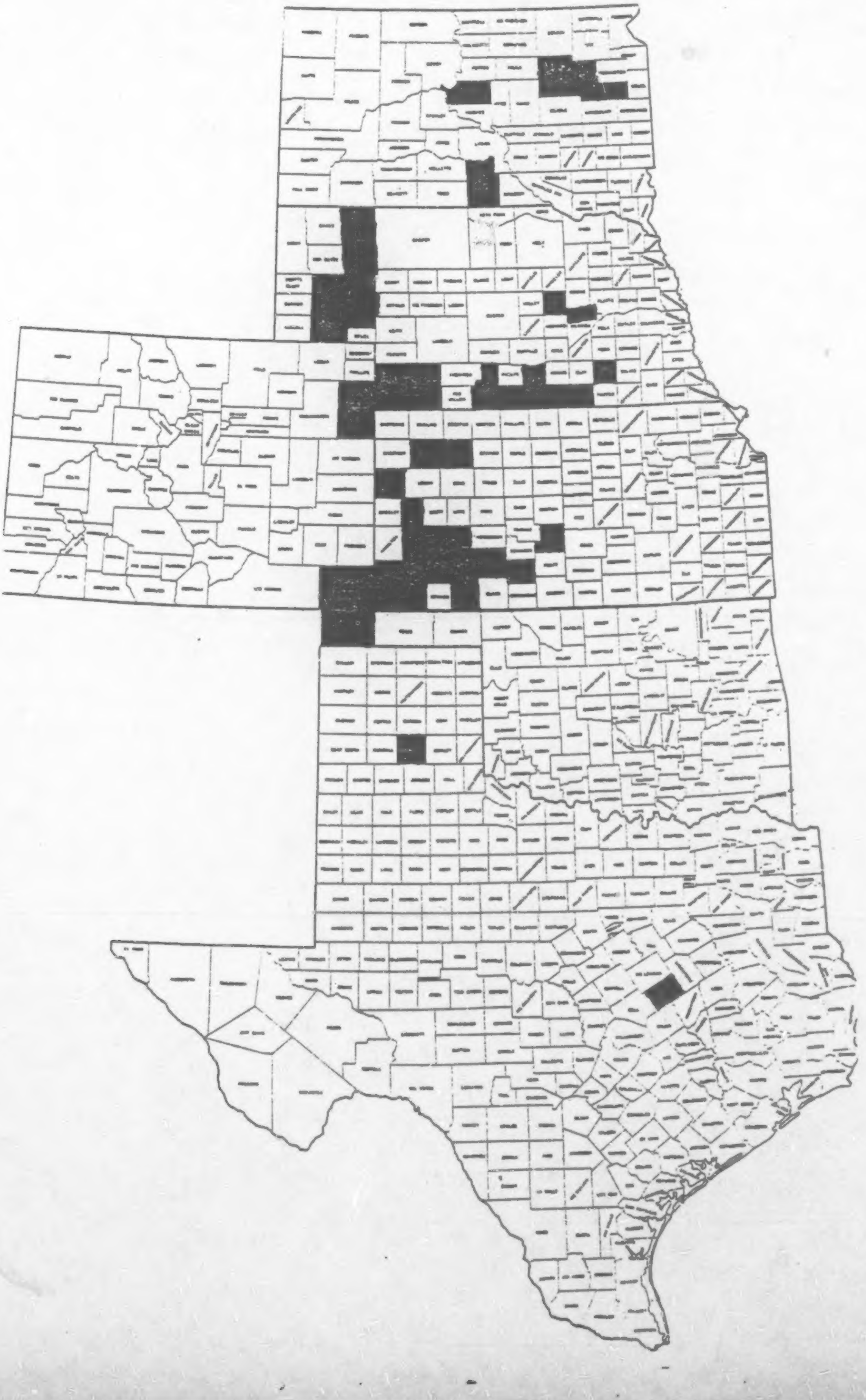


FIGURE 4. MIXED CROP AND LIVESTOCK COUNTIES



Background Paper No. 4

Emerging Agricultural Technologies, Farm Structural Change, Public Policy, and Rural Communities in the Northeast

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Cornell University

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EXECUTIVE SUMMARY

This report reviews recent empirical literature on the interrelations among technological change, farm structure, and rural community well-being in the Northeast and reports the results of an empirical study of these interrelations during the 1970s.

The review of empirical literature led to several major conclusions. First, farm structure in the Northeast is quite similar to that of the U.S. as a whole in terms of farm size distributions, input usage, land tenure, forms of legal organization, and other characteristics. Second, the Northeast did not experience rapid farm technological change during the 1970s. Third, the Northeast's nonmetropolitan population has long been relatively privileged (by comparison with that of the other U.S. regions), and while there has been regional convergence in the socioeconomic well-being of nonmetro populations, the nonmetro people of the Northeast enjoy relatively favorable income levels and access to services. Fourth, by national standards the nonmetro counties in the Northeast have a low dependence on agriculture, and industrial and service employment has long been more important than farm employment for Northeast nonmetro residents. Fifth, the most rural counties in the Northeast are not necessarily the most agricultural; many of the most important agricultural counties in the region (judged on the basis of gross sales) are metropolitan counties or nonmetro counties with substantial urban influence. Sixth, the predominance of dairying and of unfavorable agroclimatic conditions in the region are among the most important farm-level factors affecting technological change and farm structure in the region. Seventh, federal dairy commodity programs, nonfarm employment opportunities for farmers, and transportation costs are the most important nonfarm factors affecting technology and farm structure in the Northeast.

On the basis of the review of literature, it was anticipated that technological and farm structural change would tend to be relatively unimportant in influencing the socioeconomic conditions of rural areas in the region. This notion was tested with data on change in technology, farm structure, and nonmetro county characteristics using 1969/70 and 1978/80 census data. The relationships were examined among all nonmetro counties in the region (N=105) and among counties in which five percent or more of labor-proprietor income was derived from agriculture (N=30).

The results of the empirical study of Northeast nonmetro and agricultural counties were as follows. Technological change was found to be relatively unimportant in affecting farm structural or rural community change over the 1970s decade. Change in the size of the farm population, in the proportion of full-owner farms, and in the proportion of part-time farmers had significant impacts on rural community well-being, especially among the more agricultural counties. Each of the relationships was positive, indicating that conditions involving an increased farm population, an increase in the proportion of full-owner farms, and an increase in the proportion of part-time farms would be expected to yield improvements in community well-being. None of these relationships, however, appeared to reflect an indirect effect of technological change, and each of the relationships was relatively modest. In our judgment, two conclusions are warranted given the empirical study and the review of existing literature. First, in the main, technological change and farm structural change are not likely to have broad effects on rural communities in the Northeast region in the coming decades. Second, in the minority of Northeast counties that remain relatively agricultural, farm structural changes will have moderate impacts on rural community well-being. We estimate that there are, on the average, six rural trade centers and villages in each of the 30 relatively agricultural counties in the Northeast region that will be affected by future technological and farm structural changes.

The final major section of the report discusses likely technological and farm structure changes in the Northeast region over the next one to two decades. The evidence suggests that the most important changes will revolve around bovine growth hormone (bGH) technology in dairying, which will greatly exacerbate already severe overproduction problems in the dairy industry and lead to a substantial shake-out in the national and regional dairy industries. Several other technologies that will affect other plant and animal sectors in Northeast agriculture may have significant impacts on farm structure, but these impacts will likely be overshadowed by those related to bGH. It is anticipated that there will be a substantial decrease in the number of dairy farms in the Northeast region, probably at rates comparable to those of other U.S. dairy regions. It is argued, however, that these declines in the number of dairy farms in the region will not lead to an industrial-type agriculture in the Northeast. Further, the character of dairying in the Northeast will likely result in a weaker trend toward a bimodal distribution of dairy farms than will be the case in other U.S. regions. Nonetheless, it is almost certain that there will be substantially fewer and larger farms in the Northeast in the year 2000 than there are at present.

It is argued that forseeable public policies will be unlikely to stem the tide toward fewer and larger farms in the Northeast. Data suggest that certain types of public policies could greatly speed the movement toward a more biomodal structure of dairying (and, hence, of the larger farm structure) in the Northeast. However, even the most interventionist of plausible public policies would have little effect in slowing the decline of dairy farm numbers and the increase in the scale of dairy farming in the region. Implementation of a comprehensive rural development policy is likely the most effective policy measure to deal with the adverse consequences of technological and farm structure change which rise in the Northeast.

Given the major structural implications for the Northeast of technological changes such as the use of bGH and on-farm utilization of ultrafiltration and reverse osmosis technologies, the report discusses the possible consequences of these changes for the Northeast. We suggest that three factors will mitigate the potential for serious dislocation and structural change in the dairy industry that is widely assumed to exist. First, Northeast agriculture involves more than dairying, with the Northeast's poultry, fruits, and vegetables industries remaining important. For each of these commodities, the structural impacts of future technological changes will be less severe than those in dairying. Also, consumer demand for these nondairy commodities is likely to be more dynamic than for dairying, and farmers who leave dairying may be able to begin producing these other commodities. Second, given the nonfarm employment opportunities available to many farmers in the region, the small and part-time farming sector in the Northeast may be largely insulated from the dislocations that will result from technological change in dairying. Third, the generally minor importance of agriculture in the nonmetro county economies in the Northeast will imply less severe impacts on rural nonfarm households and rural communities than will be the case in other regions.

A brief historical analysis of the relationships among technological change, farm structure, and rural community well-being is given in Appendix A.

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I. INTRODUCTION

This report is devoted to reviewing the historical and contemporary literature on the relationship between technological, farm structural, and rural community change in the Northeast Region with the goal of increasing our understanding of how emergent agricultural technologies will affect farm structure and rural communities over the next two decades. In addition to reviewing the available literature on the interrelations among technology, farm structure, and rural communities, the authors will present the results of an empirical study conducted for the purpose of this report. We will also advance some tentative ideas about likely scenarios for farm structural change in the year 2000 for the Northeast and, for each scenario, will discuss the public policies necessary to bring it about and its likely consequences for rural communities in the Northeast.

A. Definition of a Rural-Agricultural Community

For purposes of this report, rural communities are defined as places with less than 20,000 inhabitants in a nonmetropolitan county (see Hines et al., 1975, and Brown and Beale, 1981, for discussions of the distinction between metro and nonmetro counties). Particular emphasis will be given to nonmetropolitan counties in which agriculture accounts for a relatively large (≥5 percent) proportion of labor-proprietor income. The Northeast Region includes six New England and three Middle Atlantic states, as described below.

B. Plan of the Study

The initial portion of the report will be devoted to surveying the major research literature on farm structure and rural communities in the Northeast for the period from 1970 to the present. We emphasize the post-1970 period for three major reasons. First, the years from 1970 to 1980 represent the most recent decade-long period for which change in agricultural technology, farm structure, and rural community conditions can be examined empirically. Second, the Northeast (and the U.S. as a whole) post-1970 witnessed a new pattern of farm structural change in the 1970s; whereas the farm population and the number of farms in the Region generally were in continuous decline from 1900-1970, the period from 1970 to the present has generally been one of stabilization of farm numbers and, in several states in the Northeast, has involved small increases in the number of farms. Third, the Northeast and the U.S. as a whole exprienced a new pattern of rural-urban population growth during the 1970s such that its nonmetropolitan counties grew faster than its metropolitcan counties.

Among the most important points to be emphasized below are that agriculture tends to be a smaller component of the Northeast economy than is the case in other regions such as the Corn Belt and Great Plains and that the Northeast has for several decades had a relatively privileged nonmetropolitan/rural population. These characteristics of the Northeast agricultural economy and its rural communities have long historical roots, which are traced in some detail in Appendix A.

We then examine preliminary results from an empirical study of technological, farm structural, and rural community change in the Northeast, utilizing census-type data for all nonmetropolitan counties in the Region during the period from 1969/1970 to 1978/1980. These results are used to estimate the recent impacts of change in technological and farm structure on the viability of rural communities in the Northeast. These data also provide the basis for estimates of the number of rural communities in the region that might be significantly affected by emerging agricultural technologies over the next 15 to 20 years.

The final sections deal with projections of changes in technology and farm structure that have been calculated by consultants to the Office of Technology Assessment, U.S. Congress. Based on these projections, we identify the types of public policies necessary to result in three scenarios of farm structure in the Northeast: (1) reproduction of the current (according to the 1982 Census of Agriculture) farm structure, (2) a significantly more "dualistic" farm structure (i.e., with substantially higher proportions of both larger-than-family and small, part-time farms, on one hand, and a smaller proportion of medium-sized family farms, on the other), and (3) an increased number of moderate-sized farms (at the expense of large-scale farms). We then speculate on which scenario will be the most likely for the Northeast and the reasons for this assessment. Finally, given this assessment of the direction of technological and farm structural change in the Northeast, and their likely impacts on rural communities, we suggest public policies that will assist Northeast rural communities and nonmetropolitan residents in adapting to these changes.

C. The Northeast Region

For purposes of this report, the Northeast Region includes the states of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. This delineation of the region is coterminous with that used for reporting of Census of Agriculture data. To a large extent the data presented in this report will be for the Northeast region as defined above. We will, however, present some data that pertain to the Northeast-Great Lakes region utilized for purposes of reporting Census of Population data (see Hines et al., 1975; Brown and Beale, 1981). The Northeast-Great Lakes region includes the nine states noted above, plus

Maryland, Delaware, Ohio, Michigan, and parts of Indiana, Illinois, Wisconsin, and Minnesota. Finally, we will at times utilize Census of Agriculture and Census of Population data of a subregional nature--primarily data for the state of New York, which because of the presence of Cornell University has received more intensive and sustained research attention than have the other states in the region.

The Northeast Region has a certain coherence as a region, principally on the basis of its agricultural economy. Relative to the rest of the U.S., the nine Northeastern states are characterized by farm structures that involve little industrial-type farming, small average farm sizes, a pattern of specialization of commodity production in which products tend to be destined for markets in major urban centers in the region (rather than for interregional or international markets), and a longstanding pattern of loss of land in farms (which was, however, attenuated beginning in the early 1970s). Also, the farm population as a percentage of the rural (or, in terms of the more recent measure, the nonmetropolitan) population in the Northeast has, since the turn of the century, been lower than that of the other agricultural regions of the U.S.

Despite the broad similarities among the states and substate areas in the larger Northeast region, the region is nonetheless quite diverse. There are two major sources of diversity relevant to this report. One source of diversity is agroecological in nature. The six New England states (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) generally have low quality soils and short growing seasons, albeit with certain exceptions such as the Connecticut River Valley. The three Middle Atlantic states (New Jersey, New York and Pennsylvania) generally have more favorable agricultural conditions. The second source of diversity is socioeconomic in nature and relates to the dramatic variations in urban-metropolitan influence in the region. The contrasts are striking between the Boston to Washington, D.C. megalopolis and its densely-settled 35 or so million inhabitants on one hand, and the highly rural state of Vermont, which has no Standard Metropolitan Statistical Area (SMSA), on the other.

It was noted earlier that a substantial amount of the empirical evidence reported below will be from New York State. A rationale other than sheer availability of data for justifying this emphasis on New York State is that this state reflects the range of agroecological and socioeconomic diversity discussed above. Northern New York, often referred to as the "North Country," is similar to the highly rural, agroecologically-less-favored states of Northern New England; West and Central New York (the Erie Canal Belt, and the Southern and Western Tiers) represents the more favorable agroecological zones of the Middle Atlantic region; and Southeastern New York (the Hudson River Valley) is characterized by the "interstitial rural areas" (Beale, 1981:54-5) of the larger Northeastern metro belt.

II. INTERRELATIONS BETWEEN FARM STRUCTURE AND RURAL COMMUNITY WELL-BEING IN THE NORTHEAST, 1970 TO THE PRESENT

A. Recent Farm Structure Changes in the Northeast

Virtually all analyses of farm structural change in the Northeast during the first seven decades of the twentieth century have emphasized that declines in farm numbers and in the size of the farm population accelerated after World War II and that these declines were most pronounced among small farm households (see, for example, Schertz, 1979; Stanton and Plimpton, 1979; and Appendix A below). But it is now widely recognized that there emerged a distinctly new pattern of farm structural change in the Northeast and the U.S. during the 1970s; the trend of farm structural change in the 1970s was toward "dualism," in which there were increases in the relative numbers of both very large and very small farms, along with a "disappearing middle" of medium-sized, full-time family farms (Tweeten and Huffman, 1980; Buttel, 1983b, 1984). Concomitant with the 1970s trend away from rapid loss of smaller farms was the stabilization of farm numbers.

Table 1 reports data on numbers of farms by selected characteristics for the Northeast Regional and the U.S. for 1974 and 1982. These data show that the Northeast generally followed the larger U. S. trend toward a more dualistic farm structure during this period of time. For both the Northeast and the U.S., farm numbers and the average size of farms were relatively unchanged over the eight-year period. The Northeast exhibited a 3.5 percent increase in the number of farms from 1974 to 1982, along with a 4.4 percent decrease in the average size of farm, indicating that the bulk of the gain in farms was concentrated among the smallest farm sizes. U.S. farms decreased by 0.3 percent during the period.

The data in Table 1 on farm numbers by size of farms in acres underscore the dualistic trajectory of structural change in both the Northeast and U.S.; farms with less than 50 acres exhibited significant increases, farms from 50 to 499 acres declined, and farms with 1,000 or more acres increased in numbers. The Northeast Region differed from national trends only in its substantial growth in farms with 500 to 999 acres, a 10.1 percent increase, compared to a 1.6 percent decrease for the U.S., and in its more rapid increases in the numbers of farms with 1,000 or more acres than was the case for the U.S. as a whole.

The data in Table 1 suggest, on balance, that there has been a stabilization of the position of Northeast agriculture in the U.S. agricultural structure during the 1970s and early 1980s. The value of agricultural products sold in the Northeast increased more rapidly from 1974 to 1982 (67.3 percent) than was the case in the U.S. (61.6 percent), although average sales per farm grew somewhat more slowly in the Northeast than in the U.S. (61.6 and 66.9 percent, respectively). The value of land and buildings, measured either on a per farm or per acre basis, increased somewhat more slowly in the Northeast than in the U.S. The average value of land and buildings per acre in the Northeast, however, remained substantially above the U.S. average in 1982 ($1,236 and $791, respectively). Increases in the overall inventory of machinery and equipment and in the value of machinery and equipment per farm in the Northeast lagged slightly behind the U.S. averages. Finally, the Northeast continued its long trend toward decline in land in farms (a 1.3 percent decrease from 1974 to 1982, compared to the U.S. figure of -0.3 percent) and exhibited a slower rate of increase in total cropland during the 1974 to 1982 period than did the U.S. (0.8 and 1.2 percent, respectively).

The farm structure of the Northeast during the 1970s and early 1980s showed increased strength in its small-farm, part-time farming component. The number of farm operators whose principal occupation was nonfarming, who worked any days off the farm, and who worked 100 or more days off the farm increased more rapidly in the Northeast than in the U.S. The Northeast also exhibited a larger increase in the number of individual or family farms than did the U.S., which, given the fact that small, part-time farms tend to be family- or individual-type farms (Buttel, 1982b; Buttel and

Gertler, 1982), underscores the growing importance of the small-scale, part-time farming sector in Northeast agriculture.

It was noted earlier that the Northeast registered larger increases in the number of farms with 1,000 or more acres than did the U.S. as a whole. This relatively rapid growth of farms with large acreages apparently did not, however, tend to take the form of industrial-type, capital-intensive farming. The dollar value of hired labor increased less rapidly in the Northeast than it did for the U.S. as a whole (77.3 and 81.3 percent, respectively), as was the case for the number of farms with hired workers working 150 or more days per year (see Table 1,. The rate of increase in the use of chemical fertilizers and other agricultural chemicals in the Northeast was also lower than for the U.S. Also, as noted earlier, the value of the Northeast's machinery and equipment inventory increased less rapidly than did that of the U.S. Finally, while the Northeast exhibited a 56.7 percent increase in the number of corporation farms, this increase was substantially lower than the 108.6 percent increase for the U.S.

As noted in Appendix A, the Northeast has long had a low rate of tenancy. During the 1974 to 1982 period, however, the number of tenant farms in the Northeast increased considerably (23.8 percent, versus the U.S. average of -1.1 percent). This may be the case because many of the persons entering agriculture in the Northeast as small farm operators did so on rented land. Nevertheless, the proportion of tenants in Northeast agriculture remains substantially lower than the U.S. average (7.5 and 11.6 percent, respectively; see Table 2).

Table 2 reports comparable farm structure data for the Northeast and the U.S. for 1982; however, instead of reporting the numbers of farms and percent changes by selected characteristics for 1974 and 1982, Table 2 shows percent distributions and other standardized measures of farm structure for the Northeast and U.S. for the most recent (1982) Census of Agriculture. The dominant feature of Table 2 is the similarity between the farm structure of the Northeast and that of the U.S. Although Northeast farms tend to be considerably smaller than U.S. farms in average acreage and average value of land and buildings, average gross sales per farm in the Northeast and the U.S. and distributions of farms by value of gross sales are quite similar. Likewise there is considerable similarity in the distributions of farms by type of organization, tenure of operator, principal occupation of the farm operator, and prevalence of off-farm employment. It should be noted, however, that these gross indicators of farm structure may conceal important differences; for example, legally incorporated farms in the Northeast average only about 400 acres per farm, whereas legally incorporated farms in the U.S. (both family and nonfamily) average approximately 2,000 acres each. Thus, legal incorporation of farms has a substantially different character in the Northeast than in much of the rest of the U.S., where many corporation farms are industrial-type farms that are characterized by absentee ownership, hired management, and hired labor (Rodefeld, 1980).

Table 2 indicates that farms in the Northeast, while typically small in acreage relative to national standards, tend to be farmed relatively intensively. Northeast farmers tend to use higher levels of commercial fertilizers and other agricultural chemicals per acre than do U.S. farmers. Northeast farmers in 1982 derived 44.0 percent of their gross farm sales from sales of dairy products, a relatively labor- and capital-intensive commodity (Forste and Frick, 1979), compared to 12.4 percent for U.S. farmers as a whole. While U.S. farmers derived a larger proportion of their gross sales from crops than did those in the Northeast in 1982, Northeast farmers tended to devote a high proportion of their cropland to labor- and capital-intensive fruit and vegetable commodities (Schertz, 1979). Finally, despite the relatively low prevalence of industrial-type farming in the Northeast (as gauged by low proportions of corporation farms and of farms with high levels of gross sales and large acreages), the Northeast region is characterized by a high level of use of hired labor. Table 7 shows that in 1982, hired labor expenses as a percent of agricultural products sold were higher in the Northeast than in the U.S., and a substantially larger proportion of Northeast farmers hired full-time agricultural labor (150 or more days of work) than did U.S. farmers (22.2 and 13.9 percent, respectively).

The pattern that emerges from these data on farm structure in the Northeast and the U.S. is that the Northeast region has achieved parity with the rest of U.S. agriculture--and, accordingly, a comparable pattern of farm structure—and has done so by continuing and deepening its long-standing pattern of specialization in dairy products, poultry, and fruits and vegetables. The position of Northeast agriculture in the U.S. agricultural structure has become stabilized now that thousands of marginal acres have been shifted out of agricultural production. This is not to say that the farm structures in the Northeast and the U.S. are identical; the Northeast has somewhat larger proportions of very small, "subfamily" farms, lower levels of large-scale industrial farming, and a greater prevalence of medium-sized farms (i.e., with sales of $40,000-99,999) than does the U.S.

Nevertheless, farm structure in the Northeast appears to have converged with that of the nation over the past several decades; moreover, the Northeast and the rest of the U.S. exhibited comparable trends in the 1970s and early 1980s toward a more dualistic pattern of farm structure.

B. Farm and Nonfarm Factors Affecting the Structure of Agriculture and Rural Community Well-Being in the Northeast

Schertz (1979) in his chapter on "The Northeast" in **Another Revolution in U.S. Farming** (Schertz and others, 1979) identified several forces--most of them nonfarm in nature--that have affected recent structural change in Northeast agriculture. Among the factors mentioned by Schertz were: (1) urbanization and industrialization in the Region, (2) nonfarm employment opportunities, (3) dairy commodity programs, (4) the character of the Region's natural resources, and (5) changes in the costs of transporting farm inputs and products.

In 1977, 12.9 percent of the land in the Northeast Region was devoted to "urban" uses (including transportation), which was significantly higher than the U.S. average of 5.7 percent (Schertz, 1979:270). One-third of the Region's acres in urban uses in 1977 was so converted in the previous 10 years. Schertz argues that the growing urbanization of the Northeast Region has resulted in urban pressure on farmland prices and in farmland values and taxation burdens that are often high relative to the ability of the lands to generate income streams in farm production. He suggests that further urban-induced inflation in farmland values in the Northeast may result in loss of land in farms and in further decline in the position of agriculture in the Northeast. Schertz, however, notes that while urban pressures may adversely affect aggregate agricultural production in the Northeast in the future, urbanization does present greater opportunities to

Northeast farmers to pursue off-farm employment. This is particularly the case because of the industrial deconcentration--the movement of industrial jobs from large cities to small cities and rural areas--that has occurred in the Northeast Region for over two decades (Hastings and White, 1984; Young, 1984). Part-time farming made possible by expanded nonfarm employment opportunities in rural areas has historically enabled the Northeast to retain agricultural resources in small production units, rather than having these resources be consolidated into larger farming businesses (Schertz, 1979:271). The high concentration of large urban centers also enabled the Region's fruit, vegetable, nursery, and poultry producers to take advantage of large local product markets.

It was noted earlier that dairy production is the single most important commodity sector in the Northeast, representing 44.0 percent of gross farm sales in 1982, and accordingly the nature of federal and state dairy commodity programs has played a major role in shaping farm structure in the Northeast. The essence of dairy commodity programs has been for the federal government to purchase dairy products (such as cheese and butter), when necessary, to allow milk prices to reach the mandated support level. Federal and state milk marketing orders and pooling procedures have had the following impacts: (1) the price of fluid milk has been set higher than for milk used to produce butter and cheese, (2) producers receive a "pool" price reflecting the combination of fluid and "manufactured" milk, and (3) the pool price does not vary by the farmer's volume of milk sales (Forste and Frick, 1979:143). The Northeast has generally benefitted from the provisions of these federal and state dairy programs. These commodity programs have increased the overall profitability and the level of milk production in all regions, but this has been of particular benefit to the Northeast because of the suitability of its agricultural resources for dairying and the longstanding specialization of the Northeast Region in dairy production. The Northeast has also benefitted from provisions of the dairy commodity programs that have insulated its producers from competition with dairy farmers in the North Central Region and that have equalized milk prices for producers of varying quantities of milk. Schertz (1979:272) argues that "[t]hese price effects, in combination with government support of dairy prices, have encouraged more milk production, led to higher farm incomes, and slowed the decline of farm numbers in the Northeast." Schertz notes as well that changes in dairy commodity programs that would eliminate government pricing and pooling policies would reduce milk production, farm incomes, and farm numbers in the Northeast Region, as would a significant reduction of the federal price support purchases. Similar impacts on Northeast dairy producers would result from eliminating current restrictions on cheese and butter imports and ending the prohibition of sales of reconstituted milk at lower prices than for fresh milk.

The character of the Northeast's farmland resources has long affected the structure of agriculture in the Region. While there are areas in the Region where there are high-quality soils over large tracts suitable for large-scale mechanization, the bulk of the Region consists of low- or variable-quality soils with rough topography. These latter soils are a barrier to mechanization and consolidation of farmland into large units. Schertz (1979:273-4) notes that the Northeast in 1977 had only 35 million acres of land suitable for regular cultivation (land capability classes I, II, and III), representing 37 percent of the total nonfederal rural land in the Region. By comparison, 44 percent of total nonfederal rural land in the U.S. is suitable for regular cultivation, with the percentage being 64 percent in the North Central Region, the Northeast's major competitor. The nature of the Northeast's farmland resources, plus the wide availability of the part-time farming option for the Region's small ("subfamily") and medium-sized family farmers, makes it unlikely that the Region will experience rapid consolidation of farmland into industrial-scale farming units such as the 10,000-cow dairies now prevalent throughout much of the Sunbelt.

A final factor that has affected and will continue to affect agriculture in the Northeast is transportation costs. The Northeast states contain nearly one-quarter of the U.S. population but only 3 percent of its farmland. The Region is thus a major food importer. The importation of food into the Region via rail and truck transportation is obviously essential to the Northeast's food system, but low-cost interregional transportation subjects Northeast farmers to competition from other states. Because of the Region's generally low- and variable-quality soil resources, crop production per acre in the Northeast has lagged behind the U.S. average for over two decades, and the Region's aggregate farm productivity has been lower than the national average since the mid-1970s (Schertz, 1979:267-8). Thus, the Region's farmers are generally vulnerable to interregional competition. The cheap energy prices that prevailed until the early 1970s contributed to declining transportation costs and to the decline of the Northeast's share of farm cash receipts. If, as many energy analysts suggest, energy prices increase substantially over the next one to two decades, the costs of interregional transportation will rise, and there will accordingly be increased opportunities for Northeast farmers to produce many vegetable, fruit, and nursery products that are presently imported into the Region (How, 1980).

C. Social Forces Affecting Rural Communities in the Northeast: The Case of New York State

To our knowledge there have been no quantitative empirical studies, such as that of Swanson (1982) for Pennsylvania places from 1930-60, of the relationships between farm structure and rural community characteristics in the Northeast pertaining to the post-1970 period. Neither has there been a continuation of the rural community studies of the sort done by Brunner and associates (1927, 1933, 1937) into the 1970s and 1980s. There is a certain irony in the fact that as our ability to generate and analyze social data has grown, we now know less about the relationships between farm and community structures than we did 50 years ago (Larson, 1981). Lacking current information in this area, we will proceed in two ways. First, we will review some available data on trends in the changing characteristics of the nonmetropolitan population in one Northeast state, New York State. The present section is devoted to this task. Second, in the succeeding section of the report we will present selected data from an empirical study of nonmetropolitan counties in the Northeast conducted by the authors.

The major source of data for this section of the report comes from a study by Eberts (1984) on **Socioeconomic Trends in Rural New York State** prepared for the New York State Legislative Commission on Rural Resources. Eberts' study reports data for New York counties grouped into six categories--two categories of metropolitan counties and four categories of nonmetropolitan counties. The two categories of metropolitan counties consist of "downstate" (New York City-area) and "upstate" metro counties. (The criterion for distinguishing between these two types of metro counties was whether the county had less than 10 percent or 10 percent or more of its population living in "nonurban" places [with less than 2,500 residents]. The downstate metro counties all had less than 10 percent of their population in nonurban places, while the upstate metro counties all had more than 10 percent of their populations living in these smaller places.)

Eberts' typology of nonmetro counties was based on two dichotomous factors: (1) percentage of the county work force commuting outside the county of residence for employment (less than 20 percent and 20 percent or greater), and (2) size of the largest place in the county (less than 10,000 and 10,000 or more). These two dichotomous factors yielded four nonmetro county types, as described in Table 3 (Eberts, 1984:11). The four nonmetro (or "rural") county types were counties with: (1) extensive urban influence, (2) considerable urban influence, (3) moderate urban influence, and (4) limited urban influence. The section of Eberts' study of greatest relevance for our purposes was that devoted to reporting aggregate or weighted data on a number of socioeconomic characteristics for the two types of metropolitan counties and the four categories of rural counties, with our principal focus being on the rural counties.

Table 4 provides data on the aggregate populations of the four county types in New York State from 1950 to 1980. These data show, as has the work of Brown and Beale (1981) on population change in the Northeast, that rural counties in New York State generally did not experience the population declines in the 1950s and 1960s that were prevalent in many rural counties in the North Central and Great Plains regions. Table 4 indicates that for each of the four types of rural counties in New York State there was continuous, albeit uneven, population growth from 1950-1980. It is useful to note as well that the most highly rural counties in New York State (types 5 and 6--counties under moderate and limited urban influence, respectively) tended, like many other rural counties in the U.S. during the 1970s, to experience substantial population growth during the decade of the 1970s.

Tables 5 and 6 give data on the proportions of the work forces of the six county types employed in, respectively, the service and manufacturing sectors. These data indicate that in the 1970s there were surprisingly few differences in the sectoral labor force profiles of New York's metro and rural counties. For 30 years there have been relatively small differences among the six county types in service and manufacturing employment. The only exception has been counties under limited urban influence, which, until 1970, tended to have fewer workers in the manufacturing sector than the upstate metro and the other nonmetro county types. By 1980, however, the proportion of the labor force in manufacturing in the counties with limited urban influence had largely converged with that of the other county types, and, in fact, these seven most highly rural counties were the only county categories to exhibit a rise in the proportion of the labor force in manufacturing from 1970 to 1980. Table 7 provides further evidence on this point; the rural counties with limited urban influence were the only county type to experience an increase in the number of manufacturing units employing 100 or more persons during the 1970-80 period.

Table 8 provides data on the proportions of the labor forces of the six county types that are engaged in primary sector employment (which principally involves agricultural employment). As would be expected, the degree of urban influence on rural counties is inversely associated with the level of primary sector employment. The seven rural counties with limited urban influence had 7.1 percent of their collective work forces engaged in primary sector employment in 1980, while the rural county types with moderate, considerable, and extensive urban influence had, respectively, 6.0, 4.6, and 3.1 percent of their work forces in the primary sector in that year.

The data in Table 9 indicate, however, that the importance of the primary (agricultural) sector in a county economy is not positively correlated with the percentage of county land in agriculture. In fact, the rural counties with the highest proportion of primary sector employment appear to be those with the smallest proportion of land in agriculture. For example, the rural counties with limited urban influence in 1980 had a far smaller proportion of their land in agriculture (22.7 percent) than did even the upstate metro counties (32.4). Another way of putting the matter is that many of the most important agricultural counties in New York State—those which, on the basis of proportion of land in agriculture, one can infer have the highest quality agricultural lands—are relatively urbanized counties, while the more highly rural counties tend to have lower quality agricultural resources.

Table 10, which reports the number of farms by county types, suggests further that farms in New York State are by no means located largely in remote rural counties, but instead are widely distributed across the six county types (with the exception of the downstate metro counties which have relatively few farms). More specifically, over 16,000 of New York's roughly 43,000 farms in 1980 were located in the upstate metro counties or in the rural counties under extensive urban influence. The seven counties with limited urban influence contained only 5,267 of New York's farms in 1980. These observations are also manifest in Tables 11 and 12, which report, respectively, total cropland acres harvested and total market value of agricultural products sold by county type. It can be seen from Table 11 that a significant number of acres of New York's harvested cropland are located in either metropolitan counties or in rural counties under extensive urban influence. Table 12 shows further that relatively urbanized counties account for a major share of the State's total agricultural production.

Tables 13-16 give data on selected socioeconomic characteristics by county type. Table 13 reports median family income (adjusted to 1980 dollars by the Consumer Price Index) and shows that there has been only moderate variation in family income by county type for several decades. The counties with limited urban influence have long had the lowest level of median family income, and it would appear that the income position of these counties has declined slightly relative to the other rural county types over the past decade. Nevertheless, there are no dramatic income disparities across New York State counties, even though income levels in rural counties have long lagged somewhat behind those of metropolitan counties.

A similar pattern is revealed in Table 14, which gives percentages of adult populations that have completed some or more college by county type. The educational levels of the downstate metropolitan counties have generally been higher than those of the rural counties in the post-World War II period. The magnitude of these disparities has, however, continued to be relatively small in 1980. Somewhat different patterns are revealed in

Tables 15 and 16, which report data on, respectively, percentages of the labor force unemployed and of families in poverty by county type from 1950 to 1980. Table 15 shows that there has been a longstanding metropolitan/rural county differentials in unemployment rates, with rural counties, especially those with limited urban influence, having higher unemployment levels. Moreover, these disparities appear to have sharpened over the past decade. In 1980, the counties with limited urban influence had an aggregate unemployment rate of 10.0 percent, by comparison with rates of 6.3 and 7.1, respectively, in the downstate and upstate metropolitan counties. Roughly the same configuration emerges in the data in Table 16 on percentages of families in poverty; the metropolitan counties have historically had lower proportions of families in poverty than have the rural counties. In 1980, the counties with limited urban influence had 16.0 percent of their families in poverty, the highest rate among the four rural county types. The major departure of the data in Table 16 from those in Table 15, however, was the sharp increase in the poverty rate in downstate metropolitan counties, which increased from 12.8 percent in 1970 to 16.3 percent in 1980. Thus, in 1980, the New York State county types with the highest levels of poverty were the most urban (the downstate metro) and the most rural counties. The lowest poverty rates in 1980 were observed in the upstate metropolitan counties.

D. Implications for the Interaction of Agriculture and Rural Communities

These New York State data suggest several tentative observations relevant to the contemporary relationships between farm structural and technological change and the socioeconomic condition of rural communities in the Northeast Region. First, the data reviewed above suggest that agriculture in New York State is by no means confined to highly rural counties (see Schertz, 1979, for a similar observation with respect to the Northeast Region as a whole). Table 12 indicates, moreover, that in terms of the value of agricultural products sold, the most dynamic agricultural counties in New York State have tended to be in the rural counties with extensive urban influence; this county type was the only one to have exhibited an increase in the value of agricultural products sold from 1970 to 1980 (in constant 1980 dollars). Moreover, the rural counties with limited urban influence exhibited a significant decline in the value of agricultural products sold from 1970 to 1980 (see Table 12). Thus, to the degree that the more rural and agricultural regions of New York are experiencing major changes in their agricultural sectors, these changes appear to be related more to the overall decline of the farm sector due to low-quality agricultural resources than to the dynamism of technological change, concentration of agricultural assets, and the replacement of family-type farms by larger-than-family or industrial-type farms.

Second, the nonmetropolitan population in New York State and in the Northeast in general (Schertz, 1979; Hines et al., 1975) has for several decades had a relatively "urban" economic and labor force structure. For example, in 1970 U.S. nonmetropolitan counties had 24.3 and 27.2 percent of their labor forces in, respectively, manufacturing and service employment (Hines et al., 1975:35). Table 5 above indicated that in 1970 all rural county types in New York State had in excess of 63 percent of their labor forces in the service sector, while Table 7 showed that for this same year all rural county types except the rural counties with limited urban influence had proportions of the labor force in manufacturing above the U.S. nonmetro county average. The combined services and manufacturing shares of the New York State rural county labor force in 1970 were all in excess of 90 percent, compared to 51.5 percent for U.S. nonmetro counties as a whole. Put somewhat differently, the data reviewed above demonstrate that rural counties in New York State (and the Northeast) have a significantly lower share of their labor forces in agricultural and other extractive industries than do the other major regions (especially the North Central and West Regions; Hines et al., 1975:35). The major implication of these data is that New York State (and presumably Northeast) counties have, by national standards, a relatively low dependence on agriculture, and, given their already highly "urban" economic bases and labor force profiles, there are likely to be relatively few counties in the Northeast that will be highly affected by technological and structural changes in the farm sector.

Third, the data reviewed above do not suggest the existence of any striking patterns of socioeconomic decline among the nonmetro population that might be attributable to adverse impacts of farm structural change on rural communities. There remain relatively modest metropolitan/nonmetropolitan disparities in median family income, and income disparities among the four rural county types in New York State are similarly modest. Poverty rates among the rural county types remained virtually unchanged from 1970 to 1980. The only indicator of deterioration of the socioeconomic condition of the New York State nonmetro population was the sharp rise in nonmetro/rural unemployment rates from 1970 to 1980. These increases in unemployment rates, of course, paralleled national trends during the 1970s. There was, however, some evidence in Table 15 that there was a widening of metro/nonmetro disparities in unemployment rates in New York State during the 1970s; moreover, the highest unemployment rates in New

York State were observed among the rural counties with limited urban influence. Nevertheless, the overall character of the data on the nonmetropolitan population in New York does not indicate that there has occurred any dramatic relative or absolute deterioration of the socioeconomic well-being of the rural population that might be attributable to adverse impacts of farm structural change on rural communities.

III. TOWARD A MODEL OF TECHNOLOGICAL, FARM STRUCTURAL, AND RURAL COMMUNITY CHANGE IN THE NORTHEAST

A. Preliminary Considerations

There has emerged over the past 10 years a significant empirical literature on the impacts of farm structural changes on rural communities in the U.S. (see, for example, the reviews and summaries in Harris and Gilbert, 1982; Heffernan, 1982; Buttel, 1983a). This literature, most of which has been inspired by the "rediscovery" and reissue of Walter Goldschmidt's (1978) **As You Sow,** has generally confirmed the fact that a cluster of changes that have occurred in the U.S. farm sector during the post-World War II period--technological change, the trend toward fewer and larger farms, the disproportionate decline of "family farms," the rise of industrial-type farming, decline of the farm population, and so forth--have tended to have adverse impacts on rural communities. It has been argued, however, that the "Goldschmidt thesis" likely does not hold uniformly across the farming regions of the U.S. and that this approach has significant theoretical and methodological limitations (see, for example, Buttel, 1982a; Hayes and Olmstead, 1984). Indeed, the bulk of the empirical research that has provided support for the Goldschmidt thesis has been conducted in states and regions in which there is a high dependence on agriculture (e.g., Flora and Conboy, 1977) and/or in areas in which highly concentrated, industrial-type farming is much more prevalent than in the nation as a whole (e.g., MacCannell and White, 1984). Most importantly for our purposes, there has been only one such study in the Northeast Region which has been conducted in the general methodological tradition of the "Goldschmidt-thesis" literature--that of Swanson (1982), reviewed at some length in Appendix A--and this study was concerned with farm structural and rural community changes (in Pennsylvania) for the **1930-1960** period. Thus, our intention in this section of the report will be to develop an empirical model that estimates the applicability of "Goldschmidt-type" hypotheses to the experience of the Northeast's nonmetropolitan counties during the past decade.[1]

B. Development of the Model: Theoretical and Methodological Considerations

The model of farm structural and rural community change that will be estimated below can be said to be largely in the Goldschmidt tradition, at least insofar as research stimulated by Goldschmidt's **As You Sow** has primarily tended to emphasize areal ("ecological") data based on indicators derived from the Censuses of Population and Agriculture. Moreover, there is a relatively close correspondence of the model that will be examined below and the implicit model structure developed in **As You Sow** and in subsequent literature (bearing in mind that Goldschmidt's [1978] study had only two cases and was largely qualitative in nature).

The adoption of the major elements of the Goldschmidt-type model is not to ignore some of its major theoretical and methodological limitations. For instance, this model (and our elaboration of the model) ignores the reciprocal impacts between farm structure and rural communities—e.g., how community territorial expansion, property taxation, and provision of services affect its farming hinterland. Aside from some danger of misspecification of the model, we do not, however, feel that this limitation of the model is a major problem for our purposes, especially because our major interest is in the impacts of farm sector changes on rural communities (and not vice versa). There are, moreover, certain limitations of the original and many subsequent applications of the Goldschmidt model that can be rectified within the context of the approach taken here. For example, unlike Goldschmidt's original formulation, we will be able to: (1) include measures of two dimensions of technological change (mechanization and use of biochemical inputs), (2) utilize measures of farm structure that reflect recent trends toward dualism, and (3) consider dependence on agriculture and influence of urban-industrial context as, respectively, contextual and control variables (see Swanson, 1982).

The model we outline below has three principal theoretical-methodological assumptions. First, we assume that the properties that we will measure—ranging from indicators of technological and farm structural change to change in the size of the farm and rural populations and in the socioeconomic characteristics of rural areal aggregates—are, indeed, variable properties. That this is the case is implicitly supported by the fact that previous studies have been successful in identifying and explaining such variations and is supported more explicitly by the data reviewed above and by other studies (Gregor, 1982; Dorner, 1983).

A second, and more problematic, assumption is that these variables can be usefully measured at the county level. There is, of course, an obvious disparity between the conceptual language that we have employed--rural communities or places and their farming hinterlands--and that which is implicated in the use of county-level data; counties contain a large number of communities and typically exhibit a high degree of variation in the population sizes, economic bases, and other characteristics of communities. There are also certain within-county variations in agricultural structure, although given the general tendency in U.S. agriculture for regions or subregions to have a fairly high degree of homogeneity in farm structure (Cochrane, 1979; Gregor, 1982), this should not be a major problem. Nevertheless, the heterogeneity of community conditions within any particular county is a significant issue and a potential limitation of the present study. We would argue that this limitation can be approached in two ways. One is to urge caution that these results should not be used to infer directly how farm structure affects rural communities in the Northeast; if such impacts are detected in the model, it would be prudent to assume that the strengths of relationships are likely to be substantially variable across rural communities, depending upon their characteristics. A second approach to the limitation of a high level of ecological aggregation is to note that one of the theoretical premises of the model that is developed below--that farm structural impacts on rural communities are likely to be confined to communities that are highly dependent on agriculture--will cause us to limit our population to a set of counties that contain relatively little variation in the size of places. We will focus our analysis on a subset of nonmetropolitan counties in the Northeast and, further, will give principal emphasis to nonmetro counties in which 5 percent or more of county income is derived from agriculture. Restricting ourselves to nonmetropolitan counties eliminates counties with places larger than 50,000 inhabitants (and, as well, eliminates counties in which a large number of persons commute to an adjacent metropolitan county for work). Further, eliminating those nonmetro counties with low proportions of income derived from agriculture should, in general, result in a deletion of counties with a high degree of spatial (community-level) and socioeconomic diversity. Thus the theoretical logic of this study serves to reduce the problem of within-county community heterogeneity that would otherwise reduce the generalizeability of the results.

The third broad assumption of the study is that recursive equations will be adequate for estimating the relationships among technological, farm structural, and rural community variables. This assumption of recursivity involves the notion that the relationships between variables are not, in the main, of two-way causality or, put somewhat differently, that the effects are largely if not entirely unidirectional. This assumption would appear to be warranted for two reasons. First, the logic of recursive equations has been applied successfully in previous research on this issue. Second, there is no existing research at the county level, to the best of our knowledge, which has demonstrated that the effects of rural community structure on farm structure are large or approach the strengths of relationships found in analyses postulating causality in the opposite direction.

The basic structure of the model we employ is set forth in Figure 1. The model is intended to set forth the general nature of relationships that would be expected based on existing literature. As emphasized earlier, however, the relationships especially those involving community socioeconomic conditions, are not expected to be large. The model consists of five clusters of independent variables and one cluster of dependent variables. Five dependent variables are measures of change in community socioeconomic conditions. These dependent variables consist of differences (over a 10-year span) in: (1) the proportion of families in poverty, (2) median family income, (3) retail sales per capita, (4) per capita property tax revenues, (5) the unemployment rate, and (6) the percent of housing built before 1940.

The majority of the independent variables--the technological change, farm structural change, farm population change, and rural population change clusters--reflect a postulated causal logic, which is discussed below, involving the ways that change in the farm sector affects rural communities. The fifth cluster of independent variables reflects characteristics of the regional socioeconomic context of farm structure and rural communities and consists of measures of the proportion of the labor force in manufacturing and service sector employment, percent of the population living in urban places (i.e., with 2,500 or more inhabitants), and a dichotomous indicator of the proportion of income derived from agriculture (5 percent or greater and less than 5 percent).

The logic of farm technological and structural change and its possible impacts on rural community socioeconomic conditions is as follows. Two measures of technological change--change in the value of machinery and equipment per farm and change in the ratio of fertilizers and other agricultural chemicals to gross sales--are included as exogenous variables which reflect major causes of farm structural change through, respectively, labor displacement and increased capital-intensity. Changes in these two aspects of technology are seen, along with the regional socioeconomic context, to affect change in farm structure. Four aspects of farm structure are included: (1) a measure of the prevalence of family ownership of agricultural resources, (2) a measure of the prevalence of corporate operation of farms, (3) a measure of the prevalence of part-time farming, and (4) a measure of change in the composition of the farm labor force.

Further, technological change and farm structural change are seen to affect change in the structure of the farm population. Variables reflecting change in the farm population include indicators of: (1) change in the size of the farm population, and (2) change in the number of agricultural laborers employed for 150 or more days. Technological, farm structural, and farm population change are posulated to affect change in the size of the rural population. Finally, the five clusters of independent variables are seen to affect the five indicators of change in community socioeconomic well-being.

The definitions of all variables in the study and the data sources are given in Table 17. The procedures used in estimating the regression equations will be discussed in conjunction with the presentation of the results.

IV. RESULTS OF THE ANALYSIS

The results of the analysis are discussed in the following four subsections. The first discusses the relationships between technological inputs and change in the structure of farming in the northeast. Second, the impact of change in the farm sector on change in population size and composition is considered. Third, the effects of change in farm sector and population characteristics on changes in indicators of community well-being are discussed. A final subsection offers our summary and conclusions.

There are 217 counties in the northeast region, of which 107 are nonmetropolitan. The Census of Agriculture did not report figures for two of the nonmetropolitan counties because the number of farms in each county was too small to avoid disclosure problems.* The remaining 105 counties provide the basis for our analysis. We considered it important to distinguish a subset of counties which were judged to be the most dependent on the agricultural economy. Therefore we selected those counties in which five percent or more of the total income in the county was derived from agriculture (see Table 18). Each phase of the analysis was conducted for both the total number of nonmetropolitan counties and the subset of counties which we have labeled "agricultural." Thirty counties (only 29 percent of all the nonmetropolitan counties) fall into this latter category. Assessing the social impacts of change in agriculture in the northeast is difficult given the relatively minor role which agriculture plays in the local economies of most nonmetropolitan counties.

Variables used in the following analyses are measured as simple gain scores (the absolute value of change) over a nine- to ten-year period of time, with four exceptions. The two variables which measure regional socioeconomic context--percentage of the labor force in services and manufacturing (NFEMPLOY), and percent urban population (URBAN)--are measures of 1970 characteristics. A third exception is change in gross farm sales (SALES), which is measured as a percentage change between 1969 and 1978. The fourth exception applies to time-one measures of the dependent variables in the analytical models. These are included to control the effect that initial size differences on a dependent variable exert on differences in the gain scores associated with that variable.

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*Hamilton, New York, and Nantucket, Massachusetts.

There are several methods of modelling change analysis in a panel design (e.g., Kessler and Greenberg, 1981). The approach employed in the following analyses is one which emphasizes the relationships between contemporaneous changes in the independent and dependent variables, after differences in the initial sizes of dependent variables are statistically controlled. Coefficients for our independent variables do not refer to effects on percentage changes in the dependent variables over time, but rather to effects on differences between values of the dependent variables at time-one and time-two.

Table 19 displays means and information on the distribution of the variables used in the analyses. Because each of the variables measures change over a period of time (except NFEMPLOY and URBAN; see Table 17), the means and distributions offer insights into recent trends in a variety of changes in the characteristics of nonmetropolitan northeast counties. Each of the means is an estimate of the average difference between time 1 and time 2 measures of each variable. It is interesting to note the differences between the mean changes for all nonmetropolitan counties and agricultural counties. As expected, we observe no evidence of notable declines in socioeconomic indicators which might be attributable to change in the structure of farming.

In the analysis reported below, we refer to correlation coefficients and to models based on ordinary-least-squares regression techniques. Bivariate correlation coefficients are reported in Appendix B. The variables are measured in terms of simple gain scores; thus, the coefficients measure the relationships among contemporaneous changes in technology, farm structure, population, and community variables.

A. The Impact of Technological Inputs on Changes in Farm Structure

In a preceding section we outlined our rationale for expecting that change in technological inputs would not be significantly related to change in the indicators of farm structure. Table 20 reports the results of our assessments of these relationships. The standardized regression coefficients for the model allow us to compare the importance of each variable in each of the farm structure models. Our interest is focused on the effects of machinery and chemical inputs after controlling the effects of change in gross sales and change in the nonfarm sector.

Among all nonmetropolitan counties, change in the value of machinery and equipment per farm is negatively associated with change in full-owned and part-time farms. In other words, where the value of machinery and equipment has increased most, the percentages of full-owned and part-time farms have declined or increased least. However, it should be noted that the proportion of explained variance for each of these two models is quite low. The machinery coefficients predicting change in the percentage of corporate farms and change in the number of workers per farm are relatively small and insignificant compared to other variables in the models. Change in chemical inputs is negatively related to changes in the percentage of corporate farms and the number of workers per farm, and is positively related to change in the percentage of part-time farms.

The models which apply to the more agriculturally dependent counties reveal some differences in the patterns of association. Change in the per farm value of machinery and equipment is related to change in the farm structure indicators in essentially the same ways as it is for all nonmetropolitan counties; the coefficients, however, are relatively small.

CHEMICALS is positively associated with change in full ownership, but is relatively insignificant in the model. The coefficient for CHEMICALS in the model for change in part-time farming indicates that this variable is the single best predictor of change in the model. Yet the total variance explained in three of the four farm structure models applied to the more agricultural counties is quite low, the exception being the model for workers-per-farm, in which change in gross sales provides a significant predictor of change in this indicator of farm labor force composition.

B. The Impact of Change in Technology and Farm Structure on Change in Population Size and Composition

We expected that change in the size and composition of the population in nonmetropolitan counties between 1970 and 1980 would not be closely related to changes in farm sector variables over that time period. The relatively high level of rural-urban, farm-nonfarm integration in the northeast region suggests that change in the population variables has been due more to changes in the nonfarm sector than to changes in the farm sector. However, change in the number of hired farm workers in the labor force is expected to be related to changes in the structure of farming, and changes in farm sales and the percentage of incorporated farms are likely to be associated with change in the reliance on hired labor.

In Table 21, correlation coefficients are presented which estimate the relationships between each of the population and labor force variables and a number of indicators of farm and nonfarm characteristics. The first-order coefficients control for the influence of the initial size on change in the size of a population and change in the size of the hired labor force. The third-order coefficients (in parentheses) estimate correlations among the variables after the effects of initial size and nonfarm contextual variables have been controlled.

The trend toward increasing numbers of regularly employed hired farm workers appears to be associated with growth in the farm economy and with the mechanization of farming. Change in the percentage of incorporated farms, which can be considered an indicator of the changing scale of farm operations,[2] is not highly related to change in the number of workers, contrary to expectation. Increase in the number of hired workers is apparently occurring across farms of varying sizes and in areas where production is becoming more mechanized. However, in the more agriculturally dependent counties, where the mean increase in number of hired workers is greater, mechanization is less related to changing numbers of workers and change in total sales is much more highly related to the number of hired workers.

Change in the size of the farm population is also positively associated with mechanization and sales, although to a lesser extent. Changes in farm structure are not highly related to changes in farm population size, with one exception. The extent of full ownership within the farm sector is positively associated with farm population change in the more agricultural counties. Nonfarm employment is positively associated with change in the size of the farm population, even though change in the percentage of part-time farms is not.

None of the farm sector or contextual variables is related to change in the size of the rural populations of the total sample of nonmetropolitan counties to a significant extent. There is more evidence of such relationships within the agricultural segment of counties: Changes in sales and mechanization are negatively related to change in the size of the rural population. The coefficient for WORKFARM suggests that in the more agricultural counties the increasing scale of farm operations is associated with rural population decline or less rapid growth. Change in the rural populations of the most agriculturally dependent counties has been more closely related to changes in the farm sector than it has been for nonmetropolitan counties generally.

To summarize, change in the general state of the agricultural economy and in mechanization are positively but modestly associated with change in the farm population and the regularly employed hired worker segment of the labor force. These four indicators have tended to increase and decrease together. Change in the total rural population has generally not been associated with changes in the farm sector, although the relationships are stronger in agricultural counties. Full ownership is positively related to farm population change, and within the agricultural counties corporate farming is negatively related to farm population change. With these exceptions, changes in the organizational structure of farming (incorporation, full ownership, part-time farming, and workers per farm) are generally not associated with population and labor force changes.

C. The Impact of Changes in Technology, Farm Structure and Population Characteristics on Change in Community Socioeconomic Well-Being

We have noted above that there are no striking patterns of social and economic decline evident in the nonmetropolitan counties of the northeast for which change in the agricultural sector might account. The extent of association between change in the farm sector and community changes is examined below in three ways. First-order and third-order correlation coefficients are reported in Tables 22 and 23. The first-order coefficients control the effect of initial size on the change score variable, and the third-order coefficients control the effects of the initial size and the two nonfarm variables. In Table 24, results of regression analyses are presented. Unstandardized coefficients are reported. The full model is fit for all nonmetropolitan counties. For the agricultural subset of counties, a step-wise regression technique was used to identify the best four-variable model for each of the community well-being variables. Preliminary regression analysis led to decisions to eliminate certain variables from the analysis. The technology variables (MACHINERY and CHEMICALS) did not have appreciable direct effects on indicators of community well-being when other factors were taken into account and they were eliminated from the list of independent variables. The model for change in the unemployment rate explained less than 10 percent of the variations in this indicator, thus it was dropped from the analysis also.

An interesting pattern emerges when considering the poverty and income models together. Change in the proportion of the farm population (FARMPOP%), the proportion of fully-owned farms (FULLOWN), and change in the vitality of the local farm economy (SALES) are all associated with improved community well-being. The coefficients and the direction of the relationships suggest that when the farm population declines as a proportion of county population, when the proportion of fully owned farms declines, or when total farm sales in a county remain relatively stagnant or decline, poverty rates tend to increase. The effect of corporate farming appears to be negative, on balance. Change in this variable is positively associated with the poverty rate and negatively associated with median family income, especially in the agricultural counties. Changes in full-ownership and part-time farmer percentages are positively associated with improved poverty rates and median family incomes, with full-ownership being the most significant contributor to explaining change in these community variables.

Retail sales are related positively to changes in the farm proportion of the population. The strength of the association across both types of counties indicates that where the farm population declined, retail sales per capita tended to decline. Interestingly, the rate of change in farm sales appears negatively related to retail sales change, as does corporate farming, although both are statistically insignificant in the regression models. These relationships suggest that a dynamic agricultural economy does not necessarily contribute to local retail sales. Alternatively, change in part-time farming is significantly and positively related to change in retail sales within the agricultural segment of counties.

Change in housing quality appears to depend more on nonfarm influences than on the farm sector variables. Nonfarm employment is associated with poorer housing across all nonmetropolitan counties, and percent urban population is related to housing in the same way for agricultural counties. The overall quality of housing does not appear to have been affected by change in the farm sector, although there is some indication that where the farm percentage of the population has declined, housing conditions have not improved as much as elsewhere.

Beyond the contributions of variables measuring the initial scores on the dependent variables, change in the percentage of full-owned farms was the most important variable affecting changes in the poverty rates and median incomes. Where proportions of fully-owned farms have declined, incomes and poverty rates have tended not to improve as much as elsewhere.

Alternatively, where full-ownership has increased as a proportion of all farms, median incomes have tended to increase and poverty rates have tended to decline. Part-time farming is associated with incomes and poverty in the same ways.

Farm structure variables have significance in other respects. The most important variables explaining change in per capita retail sales were change in the farm population and change in the percentage of part-time farms. Each of the models indicate that change in the farm structure variables is relatively important to explaining changes in indicators of community well-being, but the goodness-of-fit statistics cause us to introduce a note of caution. Much of the variation among nonmetropolitan counties in the northeast remains unexplained by the models which we have introduced in this analysis.

D. Summary

Our hypotheses have generally been confirmed by the results of our analysis. We did not expect the technology variables to be related to changes in farm structure, nor did we expect significant relationships between the agricultural variables and changes in the sizes of farm and rural populations.

Our models assessing the impact of technological inputs on farm structure account for little of the variance in the dependent variables after the effects of initial size are considered. The directions of the relationships between mechanization and farm structure variables are as expected, and the negative relationships between mechanization and full ownership and part-time farming are statistically significant. Chemical inputs are negatively related to indicators of changes in farm scale

(CORPORATE and WORKFARM), contrary to expectations. Perhaps large-scale farms already in 1969 relied heavily on chemical inputs and thus increased least over the ten-year period. Given the poor fit of the models, we have little evidence to suggest that changes in technological inputs over the ten-year period covered in this study have had a major impact on changes in farm structure. This period may not have been a time of major structural change in northeast farming and limiting our analysis to it may result in an underestimation of the influence of technological change on farm structure.

In our models of farm and rural population change, we see little evidence of impacts due to change in other farm sector variables. The strongest evidence is that for the impact of change in fully-owned farms, which is positively associated with farm population change, especially in the most agriculturally dependent counties. Where part-time farming is increasing there is no evidence that this trend contributes to growth or stability in the farm and rural populations of these counties. Generally the farm sector variables contribute little to explaining variation in measures of farm and rural population change.

The models for predicting change in community well-being do, nonetheless, reveal some surprisingly consistent patterns of association between changes in the farm sector and other socioeconomic changes in nonmetropolitan areas. The relationships between change in full-ownership and in poverty and income suggest that this aspect of farm structure is an imimportant correlate of economic well-being, particularly in the most agriculturally dependent counties. Change in part-time farming is also associated with indicators of economic well-being and appears to contribute significantly to retail trade activity in agricultural counties.

These patterns suggest that even in the northeast, where urban and other nonfarm influences on the farm sector have been substantial for some time, we can still identify correlations between indicators of farm structure and indicators of well-being in the general community. Yet we do not have conclusive evidence regarding the significance of the changing composition of the farm sector; in particular, a trend toward large-scale production units in agriculture does not necessarily imply detrimental consequences for rural communities in the Northeast. Corporate farming does not appear to be a significant independent influence on community well-being. But the trend toward decline in the proportion of fully-owned farms would imply negative consequences based on our analysis. Our data offer little evidence that changes in the scale of farming or the form of legal ownership have had important impacts on the quality of life in rural areas of the northeast. However, tenure and the relative size of the farm population do appear to have important impacts on overall community well-being.

V. THE IMPACT OF EMERGING TECHNOLOGIES ON FARM STRUCTURE AND RURAL COMMUNITIES IN THE NORTHEAST

The preceding discussion has outlined historic changes in farm structure and rural community impacts in the Northeast and the determinants of those changes through the early 1980s. In the years ahead, a wide variety of developments in technology and public policy will have continuing impacts on agricultural production, farm structure, and the rural environment in the Northeast. Before discussing these changes in detail, it is first necessary to identify those types of technological changes which are likely to be particularly important in the Northeast.

A. Major Types of Emerging Technological Developments

In the Northeast, as in the nation as a whole, emerging technological changes in production agriculture can be grouped into several major categories.[3] Biological technologies utilize living organisms or their components in the improvement of animal and plant production. Animal production technologies include: genetic engineering techniques (recombinant DNA, monoclonal antibody production, embryo transfer); regulation of animal growth and development; animal disease control (use of rapid diagnostic tests, selection for disease resistant strains, genetic engineering); animal pest control (integrated control systems, vaccines, slow-release insecticides, etc.); animal reproduction technologies (estrus cycle regulation, embryo transfer, etc.); and developments in animal nutrition. Emerging biological crop production technologies include some of the same general types of technologies important in animal production (genetic engineering, growth regulators, disease and pest control), but also other developments unique to plant production: biological nitrogen fixation; enhancement of photosynthetic efficiency; management of insects and mites (through chemical control and genetic engineering); and weed control (new biocontrol agents, improved crop cultivars, etc.).

A group of mechanical technologies will also have an important influence on increasing the efficiency of agricultural production in the future. In animal production, these mechanical technologies include developments in the areas of: environment and animal behavior (energy conservation, optimization of stress, regulation of immune processes, photoregulation of physiological phenomena); crop residue and animal waste use (residue conversion, manure application and conversion, etc.); and robotic applications (management of feeding and reproduction, pregnancy checking, etc.). In plant and crop production, robotic applications are also likely (for example, in the harvesting of selected high value crops), but other mechanical technologies will also be important. Engine and fuel technologies, including the development of adiabatic compression ignition engines with turbocompounding, electronic engine controls, and alternative fuels will enhance agricultural productivity. Developments in crop separation, cleaning and processing will increase crop productivity, particularly for grains.

Several types of developments in information technologies will have major impacts on agricultural production systems, both crop and animal. A number of communications and information management technologies will provide greatly increased amounts of information to agricultural decision-makers and do so to permit its more efficient use. These technologies include local area communications networks and private business exchanges, more sophisticated data terminals, and a variety of software systems for database management, financial analysis and on-farm system management. Monitoring and controlling techniques, including developments in sensors, controllers, displays, and actuators will reduce plant and animal production costs and increase productive efficiency. Telecommunications technologies such as developments in fiber optics, digital communications, videotex, and personal computers will enhance the efficiency of information transfer.

Finally, although many of the technologies discussed above relate directly or indirectly to increasing management efficiency, a group of specific management techniques will enhance agricultural efficiency, particularly in the use and management of productive inputs. Water and soil-water-plant management technologies, ranging from advances in irrigation techniques to developments in plant breeding and biotechnology, offer considerable promise, especially if technological developments are integrated across scientific disciplines. Developments in the management of soil erosion, productivity and tillage, including conservation tillage and the reclamation of eroded soils, will also prove important, although technological developments in these areas will likely be of secondary importance relative to providing sufficient incentives to farmers through public policy changes to encourage the adoption of soil conservation practices. Lastly, a variety of other land management technologies and techniques will continue to prove important in increasing agricultural productivity. These techniques include multiple cropping, organic farming, controlled traffic farming and custom prescribed tillage.

B. Emerging Technologies: Implications for the Northeast

The applications of these four groups of technologies (biological, mechanical, information and management) are likely to have widely different impacts on various regions of the U.S. due to regional variation and specialization in crop and animal production and associated differences in farm management practices and farm structure. Consequently, it is important to specifically consider those crop and animal products which are particularly important in the Northeast and, thus, which technologies can be identified as likely to have particularly important effects on Northeastern farming and farm structure.

While technological changes in the production of important regionally-produced commodities such as poultry products and selected fruits and vegetables will have significant implications, the prospects for technological change in the dairy industry will be especially important. As stated previously, dairy production is by far the dominant agricultural industry in the Northeast region, accounting for 44 percent of cash farm receipts in 1982. While a number of the aforementioned categories of technological changes will affect the dairy industry in the years ahead, including embryo transfer, computer-based feeding and management, and alternative forms of waste conversion, two specific technological developments stand out in their potential impact on the dairy industry: (1) the commercial introduction of synthetically produced bovine growth hormone (bGH); and to a lesser extent, (2) the potential on-farm use of ultrafiltration and reverse osmosis (UF and RO) technologies.

Bovine growth hormone is a protein produced by the pituitary gland of a dairy animal which helps control the quantity of milk produced. Bovine growth hormone can also be produced through recombinant DNA procedures and, like the naturally occurring hormone, injected into dairy animals to stimulate milk production (Bauman et al., 1982). Commercial introduction of bGH, which is currently awaiting FDA approval, is likely well within this decade. Preliminary research trials at Cornell University have yielded increases in production per cow ranging between 10 and 40 percent depending on the stage of lactation, the latter figure corresponding with a roughly 25 percent production increase over the entire lactation (Kalter et al., 1984). While commercial introduction is unlikely to result in average yield increases of this magnitude, production increases obtainable by efficient dairy producers are likely to be sizeable. In addition, per unit production costs of synthetically produced bGH are estimated to be moderate. If these estimated costs are reflected in a competitively priced product for the dairy producer, the magnitude of the potential net gains from adoption suggests that considerable incentives will exist for farmers of all sizes to adopt bGH technology (Kalter et al., 1984).

The likelihood of on-farm use of ultrafiltration and reverse osmosis technologies[4] (UF and RO) is also of potential importance in the Northeast. Ultrafiltration concentrates fluid milk by removing water and some solid components. Reverse osmosis removes simply water from fluid milk. A third process, thermalization, can be used to both extend the on-farm storage life of milk and enhance cheese yields through heating milk directly after milking to a temperature below that required for pasteurization. Combinations of these technologies offer the promise of permitting on-farm storage of milk in greater quantities and for significantly longer periods. The advantages to the producer would be in reduced storage costs (per unit of fluid milk equivalent) and lower assembly costs, and, at the plant, in higher cheese yields. To date, application of UF and RO technologies has been confined to dairy manufacturing plants, although its spread to a portion of those dairy farms sufficiently large to afford the high initial fixed equipment costs is possible.

Technological changes in the production of other commodities of importance to the Northeast are also inevitable. In poultry production (both broilers and eggs), for example, continuing increases in production efficiencies can be expected through genetic improvements in breeding, computerization of feeding systems, and technological advances in egg handling and meat processing. In fruit and vegetable production, productivity increases may be expected to continue with the use of improved seed and tree varieties, more efficient management practices, computerized grading and packing equipment, and especially through the development and more widespread use of advanced mechanical harvesting technologies. High capacity harvesting equipment is increasingly used in the harvesting of such vegetable crops as peas, sweet corn and snap beans and fruits such as tart cherries and grapes among larger producers in the Northeast. To a large extent, the capacity of harvesting equipment defines the upper limit to a fruit or vegetable producer's size of operation. As these technologies continue to develop, the size of efficient farming operations will increase with important structural implications for the industries affected (particularly in vegetable production). Overall, however, it can be expected that technological changes in these industries will not have impacts of the same magnitude as changes in the dairy industry.

C. Impacts of Emerging Technologies on Agriculture

The impacts of the abovementioned technologies on animal and crop production yields and efficiency will be sizable in the Northeast as in the nation. In dairy production, for example, the Office of Technology Assessment projects increases in milk production per cow of nearly 14 percent by 1990 and 43 percent by the year 2000 over 1982 levels, assuming a most likely "baseline environment" for changes in technology (OTA, 1985b, p. 14). In poultry, projections of increases in egg production per layer are more modest, 5.3 percent and 12.2 percent by 1990 and 2000, respectively (over 1982 levels), under the same scenario. In both cases, but especially in the case of poultry, rates of feeding efficiency are projected to increase significantly. Yields of corn grain, an important input for dairy and poultry production in the Northeast, are projected to increase by 3.4 percent in 1990 and 20.9 percent by 2000 under the same conditions. Although specific projections for other products such as fruits and vegetables are not available, a continuation of existing trends in yield and efficiency increases can generally be expected.

Given the relatively inelastic demand faced by most agricultural commodities, these increases in productivity have potentially serious consequences for the balance between supply and demand for specific food products and for the structure of agricultural production in the Northeast. In examining these implications, three types of technological impacts can be highlighted: (1) absolute changes in the use of capital and labor inputs and in their relative use; (2) differential technological adoption rates by different sized farms; and (3) likely impacts on structural elements such as vertical coordination, producer control, market access, and barriers to entry. Each of these is considered below.

D. Input Requirements

Table 25 outlines the potential changes in capital and labor (including management labor) employed and the capital/labor ratio in animal and plant production by the year 2000, assuming the adoption of the various packages of technologies listed in the first column (and discussed above). The importance of the dairy industry in the Northeast means that changes in input usage and in the capital/labor ratio for animal (dairy) production will be especially important in determining the future demand for capital, labor, and land inputs in Northeastern agriculture. Overall, assuming likely rates of technological adoption, a moderate increase in capital input requirements for animal production is projected for the nation (Table 25) and, by extension, for the region. With a continuation of the historical trend of decreasing labor requirements, the result is a projected slight to moderate increase in the capital/labor ratio in animal production agriculture.

Underlying these general trends, certain specific impacts on production input requirements at both the farm and aggregate levels may be expected to result from the adoption of bGH, in particular. Preliminary analysis of potential farm-level impacts of bGH adoption indicates that total feed requirements will likely increase, though at a lower rate than milk production, following bGH introduction and that these enhanced production levels will require (under certain assumptions) higher energy rations and increased feeding of concentrates (Kalter et al., 1984). At the farm level, the same analysis shows that marginal returns to land and associated machinery inputs are generally constant, though increasing to cows and buildings.

The aggregate or regional implications for input requirements are more difficult to ascertain but even more critical. In the short run, the increased demand for concentrates, corn grain in particular, would no doubt increase the feeding of on-farm or locally produced corn with two results: decreasing off-farm sales of feed in many cases, and increasing the relative value of high quality cropland relative to more marginal land in specific regions. Decreased sales of feedstuffs off the farm could affect the movement of currently "surplus" feed from areas such as western New York to importing regions like New England, thus changing existing feed distribution patterns in the Northeast. Given the limited amount of high quality farmland in the region, the demand for (and price of) this land would likely increase and the competitive position of farms located in these areas (western New York, the Connecticut River Valley, and southeastern Pennsylvania, for example) would likely be enhanced.

In the long run, the impacts of bGH adoption on input requirements will clearly depend on the forthcoming adjustments in the dairy industry vis-a-vis numbers of farms, size of farms, milk prices, etc. Significant increases in milk production per cow would presumably result in a downward adjustment in cow numbers in the Northeast, given the generally inelastic demand for dairy products. This would result in a lowering of feed requirements necessary to meet dairy animals' maintenance rations, offsetting, to some extent, increased per cow feed requirements. The net effect is uncertain, but again might likely be an increase in the relative feeding of high energy feedstuffs and concentrates and an increase in the relative value of those resources (e.g., high quality cropland) necessary to produce those feed requirements.

The adoption of OF and RO technologies would have a much more predictable impact on input requirements. Adoption of these associated technologies would no doubt increase the capital requirements on adopting farms due to the substantial capital investment involved, and increase the capital intensity of the dairy operation.

A moderate increase in the demand for capital inputs is also projected for plant and crop products grown in the Northeast region, primarily corn and fruit and vegetables. Although biological and mechanical technologies may be expected to have little impact on capital versus labor usage, both information and management technologies are projected to be more capital intensive (Table 25). Even with these changes, the emerging technologies will likely be relatively less capital intensive in crop production than in animal production. Importantly, as a result of the abovementioned developments, the historical pattern of steady or lower farm employment but higher capital requirements in Northeastern production agriculture should be expected to continue into the future.

E. Rates of Technological Adoption

A second issue, the rate of adoption of new technologies by different sized farm operations, will also have a major impact on the future farm structure of the Northeast. Table 26 summarizes the likely ranges of national adoption rates of different packages of technologies by farm operations of different size categories (measured by sales). Regardless of the type of commodity or technology group, the trends in relative rates of adoption of the different technologies are similar: larger farm operations are more likely to adopt new technologies (and presumably at a faster rate). Since early adopters generally realize greater benefits from adoption than those who adopt late, larger farms may be expected to realize proportionately greater benefits from new technologies than small farms, overall, and thus may gain an additional competitive advantage.

In the dairy industry specifically, information currently available regarding the likely rates of adoption of bGH by dairy farmers basically corroborates the above conclusions. Preliminary survey findings from New York indicate that bGH adoption rate is likely to be widespread and relatively rapid (80 to 90 percent adoption within three years), and that the early adopters are likely to be those with the larger herds (Kalter, et al.). If the larger producers are the first to realize the benefits from adoption, they will be in an increasingly advantageous position relative to smaller operations. Their per unit costs of production will decline prior to offsetting output price declines, earning them short-run quasi-rents. Late or non-adopters would be placed in an increasingly noncompetitive position over time, especially if the results of non-adoption exacerbate previous poor management practices.

Although similar information on the potential adoption of UF and RO technologies is not available, the large capital outlays associated with the adoption of these technologies suggest that the early adopters again would, to an even greater extent than with bGH, be the large producers. Together, these developments imply a continuing trend toward increased size of operation in the dairy industry in the Northeast.

F. Structural Changes in Agriculture

The impacts of technological change on such structural characteristics as vertical coordination and control, market access, and barriers to entry in Northeastern agriculture are more difficult to ascertain (see Table 27). Although the projections in Table 27 do not permit many definitive conclusions regarding changes in these structural elements, two points of particular relevance to the Northeast should be noted. First, for crops such as selected fruits and vegetable products, the yield-enhancing impacts of biological, mechanical and management technologies may well result in more vertical contracting across production and marketing sectors. Thus, greater vertical coordination and producer control, larger farm size and higher barriers to entry would be expected.

Second, in the dairy industry, the likely de-facto bias toward larger farmers in the adoption of bGH, UF and RO and information technologies strongly suggests that average farm size and thus barriers to entry will increase. There is no inherent scale bias in the adoption of bGH technology itself. Small farms could theoretically adopt the technology as quickly and completely as large farms. However, the actual production-enhancing effects of bGH adoption are likely to be highly dependent on the individual producer's management ability and the overall efficiency of the farming operation. To the extent that management ability is positively correlated with farm size, larger producers would be expected to gain relatively more from bGH adoption. This would be particularly true if bGH dosages were administered through implants rather than through more labor intensive injections. Scale economies in associated farm activities such as crop production could reinforce the competitive position of the larger producer relative to the smaller one, and further raise entry barriers.

The impacts from the adoption of information technologies are less straightforward. Although communication and computer-related technologies can be viewed as scale-neutral, as with other capital inputs, it is likely that the technologies which generate the greatest production efficiencies will be those which are the most costly, most easily affordable by larger farmers, and thus entry barriers may again be increased. In the dairy industry, for example, sophisticated herd management information systems may increasingly enable very large producers to process large amounts of production, feeding, health and reproduction data on individual cows and manage the herd accordingly, an advantage generally associated with the small producer. Given the historical structure of the dairy industry in the Northeast, however, although entry barriers may remain high and further increase, it seems unlikely that major changes in vertical coordination and market access will be experienced, unless significant institutional changes in product marketing are forthcoming.

G. Farm Structural Changes: Summary

The impacts of technological change discussed above (on production input usage, adoption rates, and specific structural elements) suggest a fairly straightforward set of implications for Northeastern farm structure in the coming years. The number of small part-time farms in the region may remain relatively stable in the years ahead somewhat independent of technological and policy developments in commercial agriculture. This is likely to be the case for several reasons. First, small part-time farms in the region tend not to have dairy enterprises (Buttel and Gertler, 1982), which as emphasized earlier, is the sector in Northeast agriculture in which the most dramatic technological and farm structural changes are expected. Second, small part-time farms depend relatively little on farm income so that adverse changes in their relative position in the farm economy are unlikely to significantly threaten their survival. In commercial agriculture however, the productivity and yield increases related above combined with a relatively inelastic domestic demand for most food products and relatively modest prospects for export market expansion for products produced in the region, together suggest a decline in the number of farms needed to produce a fairly stable output. In dairy, given the likely growth in bGH usage, among other changes, the number of cows required for milk production will almost certainly continue to drop, in some areas perhaps quite sharply. In some selected fruit and vegetable products, the potential for import substitution may lead to increased production of locally produced foods. Poultry (e.g., broiler) production can be expected to increase.

The structural implications for the regional farm size distribution are also fairly clear. If the number of small part-time farms remains comparatively stable, this group may increase as a percentage of Northeastern farms. Among commercial farms, the implications of an increasing capital/labor ratio and associated cost requirements, differential rates of technological adoption with the resulting distribution of benefits, and the concurrent impacts on vertical coordination, market access, and entry barriers are similar. These developments uniformly suggest an increasing average size of operation and an increasing concentration of farm sales among a decreasing number of larger farm operations. In this manner, farm structure changes in the Northeast will likely ressemble those occurring nationally.

Several factors will make developments in the Northeast different from those in the nation, however. To begin with, the implications of the projections cited above suggest strongly that the structure of animal production agriculture will change to a greater extent than that of crop production agriculture. Thus, the Northeast may be especially affected by developments such as the commercialization of bGH. However, the farm structural changes reviewed above, though resembling national developments, will develop from a different base; in other words, because Northeastern farms are, on average, considerably smaller than the national average and because of the "non-industrial" nature of dairying, increases in average farm size and sales concentration may not have the same perceived negative effects as in the nation. Finally, as mentioned previously, because the agricultural industry throughout much of the Northeast exists within an overall urban-industrial environment, the structural changes foreseen here will likely not have as serious consequences on, for example, input industries or local economies as in other regions, where the farm sector is the dominant local economic sector.

H. Impacts on Rural Communities: Implications for Public Policy and An Estimate of the Number of Rural Places that will be Affected by Future Technological Changes

The literature review and results of the empirical study in the preceding sections of this report provide the overall context for evaluating future agricultural policies and their impacts on the nonmetropolitan population and rural communities in the Northeast. The major conclusions that we have drawn about technology, farm structure, and rural communities in the Northeast are as follows.

First, historical and contemporary data underscore the fact that the nonmetropolitan population in the Northeast region is, in absolute terms and relative to the nonmetro populations of other regions, relatively privileged in terms of having high income levels, low levels of poverty, and favorable access to public services. Second, the Northeast region has relatively few counties that, by national standards, could be considered "agricultural counties." Late-1970s data show that only one county in the Northeast had in excess of 20 percent of labor-proprietor income derived from agriculture--the criterion that is generally used by USDA and other researchers to identify agricultural counties in the U.S. Of the 217 counties in the Northeast, 107 were considered nonmetropolitan in 1980, and only 30 of these nonmetropolitan counties had 5 percent of more of labor-proprietor income derived from agriculture in the late 1970s. Thus, to reiterate, nonmetropolitan counties in the Northeast generally now have a relatively low dependence on agriculture.

Third, we found that technological change--mechanization and use of purchased soil amendments and other agricultural chemicals--had relatively little impact on change in farm structure in the Northeast during the 1970s, at least insofar as spatial variations in technological change were not associated with spatial variations in farm structural change. This empirical observation is likely accounted for by several factors:

a. Technological change in the Northeast was not rapid during the 1970s by comparison with national trends. In part, this may be due to the fact that new technologies adopted in the 1970's were applicable primarily to commodities largely produced elsewhere in the country.

b. Farm structural change in the Northeast would appear to be caused more by the character of agricultural resources in the region (the prevalence of low-quality soils, short growing seasons, and other factors that limit agricultural productivity) and by the nonfarm factors that were discussed earlier in the report. In particular, it would appear that the central factor affecting Northeast farm structure is the tendency toward the marginalization and disappearance of farms with low-quality agricultural resources. It does not appear that emerging agricultural technologies will significantly affect the fact that the region's soil resources are, on average, lower in quality than those of cropland in other regions.

Two important qualifications to this result must be noted, however. First, the fact that the farm structure impacts of technological change in the Northeast during the 1970s were relatively moderate does not lessen the importance of prior technological and structural changes in the 1950s and 1960s. As noted previously, the post-World War II era in general has witnessed an extraordinary degree of change in agricultural production technology and in farm numbers, size and structure throughout the U.S., including the Northeast. Second, the predominance of dairying in the Northeast farm economy, the likelihood of rapid -- perhaps unprecedented -- technological change in this industry over the next 10 to 15 years, and the inevitability of changes in national dairy policy all suggest that future changes in farm structure in the Northeast will likely be significant.

Our fourth and final conclusion was that during the 1970s there was only modest evidence of impacts of farm structural change on rural communities, even in the most agricultural counties in the region. Moreover, technological change did not appear to have major direct or indirect effects on the socioeconomic character of agricultural counties and rural communities in the Northeast. To be sure, in the relative handful of Northeast counties with 5 percent or more of labor-proprietor income derived from agriculture, there were some modest associations between farm structure and workforce variables and indicators of rural community well-being. But, on the whole, the nonmetropolitan social fabric in the Northeast region has generally been only modestly affected by agricultural technology and farm structure changes over the past decade. Again, though, it is virtually certain that there will be a major wave of technological change in Northeast dairying over the next decade or two. This pattern of technological change will clearly have major impacts on the farms and nonfarm agribusinesses in the region and, more than likely, will have some significant effects on small agricultural trade centers in the more agricultural, dairy-dominated nonmetro counties. We estimate that perhaps 180 rural communities might be so affected over the next 10 to 15 years. This estimate is based on the fact that there exist 30 counties with 5 percent or more of labor-proprietor income derived from agriculture and that there are, on average, a half dozen agricultural trade centers in each county. Nonetheless, the available evidence suggests that future technological change in Northeast agriculture will affect the nonfarm agribusiness sector far more than it will affect the nonmetropolitan population or small rural communities in the Region.

VI. FUTURE PUBLIC POLICY ALTERNATIVES AND THE STRUCTURE OF AGRICULTURE IN THE NORTHEAST

A. Farm Structure Scenarios

Whether the trends and projections discussed above in fact extend to the future depends on the likely future impacts of changes not only in technology but in institutions and public policy, and the extent to which developments in the Northeast mirror or diverge from national trends. This section discusses possible farm structure changes in the Northeast and related policy issues under three alternative policy scenarios. Scenario 1 assumes a continuation of the present policy environment; Scenario 2 reflects policy changes designed to speed the movement to a bimodal size distribution of farms; Scenario 3 results from policies designed to slow the concurrent trend toward larger sized commercial farms.

Farm size distribution projections under the three policy scenarios, were developed at Texas A & M University, based (in the case of Scenario 1) on Markov Chain estimates of the transitional probabilities of the shifts in farm size distributions over recent years (OTA, 1985a). Data from the Agricultural Censuses between 1969 and 1982 were used in generating the estimates. Projections were made to the year 2000 (under Scenario 1) based on historical trends in farm size distributions for total U.S. farms and for the following commodity groups: dairy, poultry, cattle, grain, hog, and cotton farms. In forming the projections under Scenarios 2 and 3, assumptions were made for the U.S. as a whole regarding the possible outcomes of two sets of policies: (1) policies to speed the movement to a bimodal size distribution (Scenario 2), and, (2) policies designed to slow the trend to larger sized farms (Scenario 3). There is no explicit linkage implied between any specific policy or technology change and its estimated impact on future farm structure. Although the farm structural distributions assumed in Scenarios 2 and 3 are largely arbitrary, they can prove helpful in considering the impacts of technological and policy changes on farm distribution.

Regional projections for the future distribution of total farms in the Northeast were derived from the national estimates as follows. The relevant commodity sector projections under each scenario were weighted by their respective proportions of regional farm numbers in 1982 (using Census data) to arrive at region-wide estimates. For the Northeast, due to the absence of cotton farms and the lack of sufficiently disaggregated Census data on hog farms, the relevant commodity sectors and their respective weights were as follows: dairy (.263); poultry (.026); cattle (.132); and grain farms (.091); all other farm types were assumed to be distributed according to the overall distribution pattern for total U.S. farms, with a weight of .488. The resulting regional size distribution projections are given along with national estimates in Table 28. The regional distributions, though derived from fairly arbitrary assumptions regarding national farm distributions, do yield some insights into possible regional structural changes and how those changes compare to national ones.

Before turning to the implications of these projections, it is important to reiterate that Agricultural Census data show that as recently as 1982, the distribution of farms (by sales category) existing in the Northeast was remarkably similar to that existing nationally (see Table 1). Small farms (less than $20,000 sales annually) accounted for 59.4 percent of farms in the Northeast and 60.6 percent in the U.S.; part-time and small commercial farms ($20,000- $99,999 in sales) accounted for 25.8 percent of farms regionally and 26.0 percent nationally; moderate-to-large commercial farms ($100,000-$499,999 in sales) represented 11.2 percent of farms in the Northeast and 9.6 of farms in the nation; and very large commercial farms (greater than $500,000 in annual sales) represented 3.6 of farms in the region and 3.9 percent of farms in the U.S. Measured other ways, by average farm acreage, for example, Northeastern farms differ from representative U.S. farms in many respects (see above discussion). Nonetheless, the similarities in farm distributions measured by value of sales are striking.

Against this background, the regional and national estimates presented in Table 28 can be evaluated in several different ways. First, it must be noted that under all three scenarios, including the continuation of present policies (Scenario 1), Northeastern farms would be distributed more equally across the four farm size categories in the year 2000 than at present. Even under what might be considered the most interventionist set of policies, Scenario 3, farms of greater than $100,000 in sales would account for 21.7 percent of farms in the Northeast versus 14.8 percent in 1982. Under the other two scenarios the trend would be even more marked. Further, under all three scenarios, small farms decline as a proportion of total farms from the level of 59.4 percent in 1982. These conclusions are, of course, based on the assumption that farm size distributions in specific commodity sectors will be the same in the Northeast as in the nation. Given these assumptions, the conclusions suggest that the national trend toward a larger farm size will likely apply to the Northeast under most realistic policy scenarios. However, the trend toward a bimodal farm distribution may be somewhat less appropriate to the Northeast which is projected to experience a more equitable distribution of farms of different sizes than elsewhere.

The second principal conclusion that can be derived from Table 28 is that regardless of the nature of possible policy changes, there will be relatively more larger farms and fewer smaller farms in the Northeast in the year 2000 relative to the nation as a whole. Each of the two categories of larger sized farms will include a greater proportion of total farms regionally than nationally. Conversely, each of the two smaller sized categories will include a smaller proportion of farms in the Northeast than in the U.S. overall. Measured simply in terms of farm numbers, the estimates do not suggest a uniform trend toward larger sized farms in the Northeast; in the region, as in the nation as a whole, farms generating less than $100,000 in annual sales still account for between 73.1 percent and 78.3 percent of farms under Scenarios 1-3. Nevertheless, as mentioned previously, in terms of commercial farm operations, it is difficult to see what would interfere with the trend toward larger size and scale of operation (except perhaps under an extreme version of Scenario 3). Again, the trends suggest a somewhat more equal distribution of farms across the various size categories regionally than nationally.

The third important trend that can be observed from the estimates in Table 28 is that, as for the nation as a whole, farm structural changes in the Northeast would appear to be relatively insensitive to policy changes designed to slow the trend to larger farm size (Scenario 3), but relatively more sensitive to policies designed to speed the move to a bimodal size distribution. Table 29 gives the changes in the proportion of farms in each size category resulting from changes in current policies to those assumed under Scenarios 2 and 3. The overall trends evidenced in these data are, of course, wholly dependent on the underlying national distribution assumptions mentioned previously. Given these assumptions, it is clear that in Scenario 2, the Northeast is slightly more responsive with regard to the impacts of policy changes among very large farms, but slightly less responsive to increases in numbers of small farms than in the U.S. in general (Table 29). The regional impacts of Scenario 3 policies are slightly greater than in the U.S. in general, in that the proportion of large farms decreases to a greater extent in the Northeast than nationally as a result of policy changes designed to slow the trend toward larger farm size.

The major factor accounting for the regional differences in policy impacts relative to the U.S. generally is the predominant role played by dairy farms and dairy farming in the Northeast. In 1982, as mentioned before, dairy cash receipts amounted to 44 percent of total farm cash receipts in the Northeast versus 12.4 percent nationally, and dairy farms represented over 26 percent of regional farm numbers. In addition, under all three policy scenarios, dairy farms are (by estimation or assumption) more evenly distributed across different size categories than are farms producing other commodities (with the possible exception of hog farms) and than U.S. farms overall. For these reasons, the regional size distribution patterns given in Table 28 are thus more evenly distributed for the Northeast than for the U.S. as a whole.

What is in the nature of dairy farming that this sector should be relatively more evenly distributed over the entire range of size categories than other enterprises? Several factors may be hypothesized to account for this result. First, the non-industrial "family farm" nature of dairy farming is important. The dairy enterprise is relatively labor-intensive suggesting that, to date, the scale economies resulting from increased capitalization have been relatively less significant in dairy farming than in other types of enterprises. Second, dairying has traditionally involved a high proportion of family-provided labor which has tended to limit the size of the dairy enterprise. In addition, the limited profitability of forage-based dairy farming compared to alternative investments outside of agriculture has precluded the growth of "industrial dairying" in the Northeast. Finally, dairy policy and the regional structure and organization of the dairy industry, in particular institutions such as price supports, marketing orders, and cooperative handling and processing, may have helped keep the small dairy enterprise profitable and viable, relative to small-sized operations in other industries.

Whatever the specific reasons, the importance of the dairy industry in the Northeast creates both advantages and disadvantages for public policy. On the positive side, the projections described above suggest that, despite the trend toward increasing size of operation, the Northeast will continue to be characterized be a highly diversified farm sector in terms of farm size. The diversity of farm types and sizes (which in reality extends to farms other than dairy, as well) represents a diversity of opportunities for young farmers for whom entry may at least be possible. Other favorable impacts could also be cited. Although the Northeast will likely follow to some extent, the national trend toward a bimodal farm distribution, the moderate size of Northeastern farms and the specific commodities produced, in particular dairy, would suggest that the effects of the national trend will be perhaps less adverse in the Northeast than in some other regions.

On the other hand, the high degree of dependence of Northeast agriculture on the health and viability of the dairy industry means that the region has much at stake with regard to future changes in policy and technology relevant to the dairy industry. In this connection, two likely future developments appear of particular importance: possible changes in national dairy policy and commercialization and use of the bovine growth hormone (and other technologies). In the policy area, movement toward a more market-oriented system would have an as yet indeterminant impact on the Northeast dairy industry. One common view is that given reasonable land and labor costs, the availability of forage and proximity to large markets, the Northeast dairy sector would likely fare well relative to competing regions. Even under these circumstances, however, dairy prices received by farmers almost certainly fall in a more "free market" environment, with potentially serious implications for the survivability of dairy farms of all types, but especially small to moderate-sized farms, in the region (OTA, 1985b). The exit of the most inefficient operators in the industry would be inevitable. The impacts on the broader agricultural industry and on specific rural communities could be substantial.

The potential impact of bGH adoption on the Northeastern dairy industry probably will probably have more serious long run consequences. As discussed previously, when bGH reaches the commercialization stage, its adoption is likely to be rapid, especially among larger farms, and fairly complete among farms of all sizes within a relatively short period of time. Given the inelastic demand faced by dairy products, a steady continuation of genetic improvements which will also be yield-enhancing, and the promise of other technological breakthroughs (such as information and UF and RO technologies), there is the potential for a much more serious production overcapacity problem than has been experienced even to date. Given the scale bias of some of these developments, the potential for serious dislocation and structural change in the dairy industry, much greater than that experienced historically, is clearly present. Yet, as discussed below, other factors suggest that the potential adverse effects of farm technology and structure changes may be moderated by a set of circumstances particularly relevant to the Northeast.

B. Public Policy Scenarios

In considering alternative public policies which could be instituted to address the problems arising from the technology and farm structure developments discussed above, two questions are central: (1) In the Northeast, are the prospective effects of these technology and farm structure changes on rural communities sufficiently large and adverse in nature that they warrant the introduction of public policies designed to stop, slow or deal with these changes?; and (2) If #1 is answered in the affirmative, then what types of policies might be most effective in mitigating the effects of these changes, in view of existing political, economic and social constraints and anticipated changes in farm technology and structure?

Justification for Policy Interventions

With regard to the first question, most of the evidence presented in this report would support the view that, based on past developments, the rural community impacts of future farm technology and structure changes are likely to be less important in the Northeast than in other regions of the U.S. As reviewed above, there are a number of factors that support this conclusion.

First, the dairy industry, the dominant sector in Northeast agriculture, and national dairy policy have afforded a stabilizing presence to agriculture and thus the rural sector of the region. Characterized by relatively small and widely dispersed farms, labor intensive operations, "non-industrial" ownership and management, and a variety of traditional institutions (price supports, marketing orders, dairy cooperatives, etc.), the dairy industry has undergone less structural change in recent years than many other agricultural industries. While a number of factors suggest that change will accelerate in the future, the dairy industry in the Northeast will not likely be characterized by the industrial type of agriculture present in some other regions of the U.S. which has figured so prominently in agricultural change in recent decades.

Second, Northeastern agriculture is diverse and involves much more than just dairy farming. A number of other sectors, in particular, poultry and fruits and vegetables, are also important. In a number of these industries, technological and structural change have been important in the past, but, in the future, farm policy changes are likely to be less important than in dairy, and consumer demand is likely to be more dynamic (except for eggs) than for dairy products. The diversity of the region's agriculture will likely prove to be a stabilizing influence in view of anticipated changes in specific sectors (e.g., dairy).

Third, the Northeast will continue to have an important small and part-time farm sector in future years which will remain an integral part of the agricultural industry. Although most of these farms will not be classified as commercial farming operations, the combination of proximity to urban areas and markets, the existence of off-farm job opportunities and the accommodation of changes in lifestyles will guarantee their continued survival, and in many cases, growth. The urbanized nature of much of the Northeast will assure a continued market for the production of these farms, such as through direct marketing operations.

Finally, because much of the Northeastern region does have a strong urban-industrial influence, if dislocation and structural change do adversely affect the dairy industry or other farm sectors, the impacts on rural economies and communities should in most cases be less severe than they would be in other regions. The existence of off-farm job opportunities and the diverse nature of many local rural economies will minimize the impacts of these changes on employment levels, rural population, and income distribution in most areas. And the development pressure on farmland throughout much of the Northeast, though generally criticized by the agricultural community, will mitigate potential slippages in land values.

These factors suggest that, in general, the adverse consequences of technological and farm structure changes on rural communities in the Northeast will likely be, in general, moderate and less serious compared to other regions of the U.S. This is not to say, however, that these changes will have no adverse impact nor that in some specific instances, that these impacts may be profound. In fact, at least three reasons can be cited as cause for concern and as possible justifications for public policy intervention.

First, there is no question that certain subregional "pockets" of the Northeast with a high dependence on agriculture may be negatively effected by technological and farm structure changes. In these subregions (parts of northern New England; New York's "North Country", etc.), technology and structure changes which, through shifting competitive forces, result in reduced farm output would have negative implications for income and employment generation in agriculture and food processing, the viability of farm input and service industries, and the overall vitality of the rural communities affected. Changes which resulted in reduced farm numbers but no reduction in aggregate output would have less adverse consequences for input and processing industries, although the rural infrastructure and community impacts could still be severe. In any case, it is clear that the socio-economic well-being of these subregions could suffer especially adverse impacts due to their dependence on agriculture.

Second, as mentioned previously, the likelihood of unprecedented technological change in the Northeast's most important agricultural sector, dairying, raises the possibility of important structural changes in Northeast agriculture which are also without precedent. The region's dependence on dairying, while responsible for stability in the past, may cause serious problems in the future as farmers are forced to deal not only with the consequences of technological change (especially the introduction of bGH), but also the current surplus production problem and likely changes in national dairy price policy.

Finally, it is useful to remember that consequences of change in agriculture go far beyond the farm production sector. The farm sector is only one part of the food system which generates employment, income and value-added in farm input industries, food processing, wholesaling and retailing, and which, of course, is an important part of the rural community infrastructure. Major changes in the farm sector when transmitted through the entire local economy may be more severe than would be indicated simply by looking at technology and structure impacts in farming only.

Policy Scenarios

The factors provide several justifications for the importance of analyzing policy alternatives which would address the concerns mentioned above. At least four specific types of policy initiatives must be addressed as they relate to technology and farm structure changes and rural communities, and the consequences of each briefly examined. These are: (1) farm commodity policy; (2) macroeconomic policy; (3) a set of regulatory, research, and related policies; and (4) rural development policy.

Commodity Policy

One of the major tools that has traditionally been in the hands of agricultural policymakers has been farm commodity policy. Of the major farm programs, clearly the one with greatest importance to the Northeast is national dairy policy. While dairy policy has been criticized on a number of grounds (see Babb, for example), one criticism that is particularly relevant here is the fact that like most other farm programs, program benefits occur in direct proportion to volume of milk produced regardless of "need". Thus, existing policies simply tend to reinforce the structural impacts of technological changes which favor larger producers at the expense of smaller or medium-sized ones.

If, on the other hand, national dairy policy becomes more "market-oriented", as many feel is inevitable, there will likely be increased pressure on dairy producers of all sizes, but particularly on small and moderate-sized dairy farms. Larger operations will likely continue to benefit relatively more from the adoption of emerging technologies, scale economies in production, and pecuniary economies in input purchasing and product marketing. Farms of all sizes, but especially small and intermediate-sized farms and those with unfavorable equity positions, will face an even tighter cost-price "squeeze", as prices fall closer to market-clearing levels and costs stabilize or rise due to inflation and/or the lack of scale economies enjoyed by smaller producers. In the aggregate, the interregional competitive impacts of changes in both technology and public policy are unknown, but with competitive production cost levels, adequate land, forage, and water resources, increased regional production of animal feeds, and a large and close market guaranteed for dairy products, it is likely that the Northeastern dairy industry will remain competitive with other major production regions. Those rural communities which are likely to suffer from "market-oriented" policy changes are likely to be those which are surrounded by large numbers of marginal farming operations and where the alternative uses of land, capital labor inputs are limited.

The other principal farm commodity programs are designed for products which are generally of relatively little or no importance in the Northeast, and so for the other major regionally-produced farm products, agricultural commodity policy changes are unlikely to have serious impacts. As a net importer of feed from surplus-producing regions, the Northeast is a beneficiary of feed grain programs to the extent that these programs raise feed production above levels which would prevail in a competitive market. A significant reduction in feed availability induced by policy changes could have negative repercussions for the competitiveness of the Northeast's animal production industries (dairy and poultry, primarily).

Could further changes in farm commodity policies alleviate the problems identified above as occurring as a result of farm technology and structure changes? Certainly, increases in dairy price supports and other measures could help moderate some of the adverse effects of these changes on specific farms, regions, and rural communities. Yet, this is clearly not the direction that farm policy is currently headed and indeed, most observers agree that a greater market-orientation to dairy policy is inevitable.

Furthermore, most of the evidence presented here and elsewhere suggests that farm policy changes are not likely to be very effective in addressing the problems identified above. As explained with regard to Table 28, farm structural changes (and presumably related community impacts) appear to be relatively insensitive to policy changes designed to slow the trend to larger farm size. Policy changes such as movement from a price support system to a direct payments scheme for dairy, decreasing per unit benefits with increases in production, placing a cap on program benefits, or basing support prices on a formula which would reflect changes in milk production costs in a more timely fashion (Babb, 1984), etc., might prove useful in more accurately targeting program benefits for those who are most in need of them. However, for an array of political and economic reasons, such changes would likely prove to be a temporary and inefficient way to solve the problems associated with farm technological and structural change.

One important reason for this conclusion is that farm commodity programs are essentially national in character, while, as has been argued here, the rural community impacts of technology and farm structure change in the Northeast are basically subregional. Development of a federal farm policy structure which is oriented toward regional problems, or the development of statewide agricultural policies might be alternatives to the current situation. However, the former is not likely to be politically viable and the latter, at least as far as commodity programs are concerned, is not likely to be affordable at a meaningful level. State agricultural policies and programs which are instead oriented toward improving the agricultural business environment, providing technical production and marketing assistance to farms and firms, supporting agricultural research and market development (including identifying market "niches" for state-produced products), etc., are more likely to be met with some success. In the Northeast, a number of states, including Maine and New York, are developing state agricultural programs along these lines. By targeting specific products, markets, and regions, individual states may be able to address problems specific to them in a way federal farm programs cannot.

Macroeconomic Policies

Important as farm commodity policy is, a host of macroeconomic-oriented policy changes will likely have an even more dominant - though oftentimes largely invisible - impact on farm structure and rural communities in the Northeast. These policy changes might include changes in monetary, fiscal, and trade policy, and/or changes in the federal tax system.

Monetary, fiscal and trade policies essentially set the levels of macroeconomic parameters such as inflation, interest rates and exchange rates, on which a farmer's cash flow and net returns are directly or indirectly dependent. While the recent abatement in inflation rates means that prices for farm inputs are holding relatively steady at present, this advantage is, for the farmer, counterbalanced by sagging prices for many farm commodities. In addition, interest rates have not declined in step with inflation leaving real interest rates on both operating loans and loans for capital investments high, a negative development for all farmers, particularly those who are highly leveraged.

One of the major policy changes which would have a favorable impact on farms and, in turn, on rural communities would be a change in fiscal policy leading to a reduction in the federal budget deficit, and, in turn, to a reduction in interest rates. The impact of such a change would be at least twofold. The decline in interest rates would ease farmers' interest costs for operating loans and make cost-reducing capital investments more affordable. Secondly, the decline in the value of the dollar vis-a-vis other currencies in the international market would make U.S. farm exports more competitive internationally, increasing export demand and, ultimately, output price levels.

Tax policies also play an important role in determining farm structural changes. These policies, while generally beneficial to farmers through provisions such as interest deductability and capital depreciation and investment tax credits, have served to provide incentives for farm expansion and the entry of industrial corporations and other non-farm entities into farming. Certain types of farm operations have become notorious tax shelters, encouraging investments in farming that would otherwise not be made. While many of these provisions have encouraged the expansion of farm operations (increasing output and lowering market-clearing prices), the availability of tax benefits to small and part-time farmers has also provided incentives for the growth of these operations as well.

A continuation of these macroeconomic policies in their current direction would likely further enhance the competitiveness of larger farms relative to smaller ones. Developments such as major tax reform, including limiting or terminating interest deductability, decreasing the benefits associated with the farm enterprise, etc., would probably increase the barriers to farm expansion thus increasing the relative viability of smaller farm operations. Clearly, though, farmers with unfavorable equity positions would be at a serious competitive disadvantage relative to those who are not highly leveraged. This would be counterbalanced by the reduced incentives for farm expansion. Thus, although the movement to a larger farm size might be slowed, entry into farming would be made considerably more difficult. Entry incentives would also decrease for those nonfarmers largely seeking to shelter income, so that the resources devoted to farming might decline relatively. It is important to note, though, that examining only the partial effects on agriculture of these macroeconomic changes can be misleading because of the many intersectoral shifts of resources which would undoubtedly occur in the event of genuine economy-wide tax reform.

Again, with the exception of a change in macroeconomic policy leading to lower real interest rates and selected changes in tax policy, it is difficult to envisage macroeconomic policies being sufficiently targetable or sector specific to resolve the technology and structure-induced problems discussed previously. Indeed, one commonly called for policy change, the further liberalization of international trade, might adversely affect the Northeast if dairy import quotas were relaxed as part of a trade liberalization policy.

Regulatory, Research and Related Policies

A third set of policy changes connected with regulatory, research and extension, and environmental and related policies would also have impacts on farm structure and rural communities. The impacts of these policies would more likely be industry or commodity-specific rather than general in impact. For example, a continuation of changes in the regulatory structure surrounding freight transportation would almost certainly have impacts on interregional and intraregional flows of feed grains with possible implications for the geographic structure of animal production in the Northeast. Yet, because agricultural freight is such a small part of the rail freight arrived in the Northeast, it is unreasonable to assume that rail freight transportation regulation could be altered with simply agriculture in mind. The problem of branchline abandonment is probably one of greater importance to most rural areas, and that has proved especially difficult to solve. The impending sale of Conrail will likely have implications for rural areas in the Northeast both in terms of shipping costs and levels of service provision. However, it is too early to tell what these impacts will be.

As with regulatory policy, it is equally unlikely that policy changes could be instituted to significantly divert the direction of technological change in agriculture and its secondary effects in the years ahead. Regulating public research is likely to be ineffectual, since two-thirds of U.S. agricultural research and development expenditures are made in the private sector and it is no longer clear that new agricultural technologies are induced entirely by public research. Moreover, many of the new technologies that will be deployed over the next two decades are already in the development stage in private laboratories and the availability of these technologies will not be affected by any public policies which could reasonably be instituted.

One type of policy change which might have an impact, albeit in the long-run, on technological and structural change in agriculture and its consequences for rural communities would be a large scale redirection of information delivery mechanisms (e.g., Cooperative Extension activities, etc.) toward smaller farms and farms in greatest need of enhanced management expertise. By helping increase the management ability of these producers, their ability to compete with better managed, often larger, farms would be enhanced. Operating against this trend, however, is the fact that the current revolution in personal computers, management information systems and new methods of delivery of information to farmers (on line data bases, videotex, etc.) will likely proceed regardless of public sector interventions. Such policies might expedite or help redirect the impacts of information transfer in agriculture but the private sector is likely to play an increasingly significant role in this area (for example, in software development for farm applications), and a role that is largely outside the purview of public policy.

As with farm policy and macroeconomic policy, changes in regulatory, research and related policies are not likely to effectively or efficiently solve the problems arising from farm technological and structural change and their resultant impacts on rural communities.

Rural Development Policy

The primary adverse consequences of farm technology and structure change in the Northeast, as mentioned previously, are the impacts on selected farms, farm families, small businesses which service the farm sector, food processors, and specific rural communities which are particularly dependent on agriculture. Given the general lack (with some exceptions) of targetability and efficiency of farm commodity policy, macroeconomic policy, and regulatory, research, and related policies in providing specific solutions to these problems, it is appropriate to ask if directly addressing the problems of employment creation, income enhancement, rural infrastructure development, etc., might not be the most constructive policy approach.

There are several important reasons why a comprehensive rural development policy approach directed toward these goals might be constructive. First, there is evidence that from the late 1960s to the end of the 1970s aspects of such a program in fact worked. Prior to the 1960s there were major regional disparities, with rural/nonmetro places and counties exhibiting lower incomes and access to services than their urban/metro counterparts. But beginning in the late 1960s and continuing through the 1970s, there emerged a distinct pattern of convergence in the socioeconomic characteristics of metro and nonmetro counties. While many factors were no doubt involved in this pattern of convergence, there is agreement that the deepening of the social welfare apparatus--transfer payments, service subsidies, extension of protective labor legislation, regional commission economic development programs, revenue sharing, small business loan programs, and so forth--played a major role.

Second, a comprehensive rural development program would be fair; it would benefit the nonmetro counties and communities of the U.S. in a relatively equal manner, regardless of their dependence or lack of dependence on agriculture. Third, there has long been hard evidence that many Americans would prefer to live in small places (rather than metropolitan places) if they had the opportunity; thus a program of this sort could be justified on the grounds that it would provide residential (and, indirectly, employment) options that are of interest to a large proportion of the U.S. population. Fourth, such a policy would have the greatest likelihood of effectively meliorating the adverse changes in farm technology and structure, since it would enhance the ability of those displaced in this process to find alternative employment in their community or region of residence. The existence of additional employment opportunities is, after all, probably the major challenge for public policy in dealing with these technology and structure-induced changes. Finally, one might add that a sustained program of rural development would likely cost less than farm commodity programs currently do and that it could provide the long-term institution-building that would help to insulate rural places from adverse farm technology and structure changes that extend into the next century.

What specific policy alternatives might be part of a comprehensive rural development policy? Clearly, the key components would be mechanisms for job creation. While the rate of job creation is primarily dependent on the growth of the overall economy, decades of experience have shown that some regions, states and subregions (urban as well as rural) lag behind other regions and the general economy in experiencing economic growth. Thus, targeting policies and programs aimed at job creation toward these regions is one of the primary tools of public policy.

Reinitiating or strengthening (rather than weakening) past and present programs including regional economic development programs, revenue sharing, business development assistance, small business loan programs, etc., are obvious alternatives. In the past, the growth of the rural manufacturing sector was seen as a major source of job creation and economic expansion.

While "high technology" and other industries may offer some promise for selected regions in this regard, increasingly, it is service industries which have become the primary instrument for job creation in rural as well as urban areas (Bradshaw and Blakely, 1983). In either case, instituting new programs would, in general, likely be less effective than strengthening the commitment to those which currently exist and are underfunded, or those programs which have worked in the past but which have been eliminated (see Hardy for a detailed discussion of recent federal involvement in rural economic development programs). Recent proposals for the creation of "enterprise zones" to stimulate local economic development may be appropriate in certain selected areas, but outside of these relatively few areas, the problems of rural economic development would remain unaddressed.

At the state level, other options are possible. The State of New York is currently considering the creation of a Rural Development Authority, along the lines of similar organizations which have stressed economic development in urban areas. Such an Authority might be able to stimulate rural economic development through helping identify emerging opportunities for rural business development, helping provide technical and/or management expertise to rural businesses, guaranteeing loans to new rural enterprises, etc. In addition, because of the closer match between regional or subregional needs and state compared to federal organizations, such an organization might be effective in identifying specific regional problems and working with rural firms and policymakers. At the same time, however, many of the problems of specific rural areas are attributable to regional and national developments and thus statewide solutions to these problems are often of limited potential effectiveness.

Beyond job development, other aspects of a rural development policy would include assistance to local governments and rural infrastructure development. For a variety of reasons, rural communities typically have a lower capacity for effective collective action than many urban areas (Wilkinson et al., 1983). Providing technical and management assistance to local governments and local government officials is one mechanism for strengthening the ability of rural communities to manage and allocate their resources effectively.

Rural infrastructure development is another important aspect of rural development policy and one in which federal government has had an important traditional role. The attractiveness of rural life is mitigated for many by the perception (often well-deserved) that rural areas are often characterized by poor roads, bridges and other physical infrastructural elements leading to difficulties in transportation and communication, a level of services that is lacking compared to urban and suburban areas, poor housing and other deficiencies. In recognition of these problems and the particularly serious impacts they can have on a widely dispersed population, a number of state governments (including New York) have recently given more attention and public funding to investment in the rural infrastructure. Federal involvement has recently been mixed, increasing in some areas, but drastically decreasing in other areas of particular concern to rural areas, rural housing, in particular (Hardy, 1983). While the quality of the rural physical infrastructure is important, the quality of the socioeconomic infrastructure of rural areas is equally critical in meeting rural needs. Thus, the abovementioned elements of a rural economic development policy are again especially important.

FOOTNOTES

1. The choice of 1969/70 to 1978/80 as the time frame for the empirical analysis has one major advantage but also a key disadvantage. The advantage is that this is the most recent decade-long period for which data are available, giving us greater confidence that the empirical patterns that are discovered are generalizeable to the current structure of the Northeast's agricultural and rural economies. But it should also be recognized, as noted above, that the decade of the 1970s was not one of rapid technological change in Northeast agriculture. Thus, our results will be limited to some degree in the inferences that might be drawn regarding the socioeconomic impacts of rapid technological change in Northeast agriculture over the next 15 to 20 years.

2. As noted earlier, legally incorporated farms in the Northeast in 1982 averaged approximately 400 acres per farm, about 2.3 times larger than the average for all census farms in the Region. The percentage of incorporated farms is, to be sure, a less-than-ideal measure of the degree to which agricultural production is concentrated in large farm units, but we feel that this measure is preferable to others available in both the 1969 and 1978 Censuses of Agriculture. Gross farm sales, in particular, is a frequently employed indicator of farm scale. There are, however, several major problems in utilizing gross farm sales categories from the 1969 and 1978 censuses as the basis for an indicator of the changing scale of agricultural production. First, due to inflation, gross farm sales categories are not comparable over time. Second, the upper bound for gross farm sales in the 1969 Census of Agriculture was $40,000 or more, which could be said to represent a category of somewhat larger than average commercial-size farms. An indicator based on farm acreage would also be inappropriate for the Northeast Region because of its highly variable soil resources. Thus we have chosen the percentage of incorporated farms as an indicator of the scale of agricultural production in preference to alternative indicators based on gross farm sales and acreage categories.

3. The discussion here summarizes that in OTA (1984a).

4. The discussion here is drawn from Boynton et al. (1984).

REFERENCES

Ali, Y. A.
1973 "Social Changes in Thirteen New York Rural communities: 1920-1970." Unpublished M.S. Thesis, Cornell University.

Babb, Emerson M.
1984 "Dairy," in **Alternative Agricultural and Food Policies and The 1985 Farm Bill,** eds. G. C. Rausser and K. R. Fanell. Gianni Foundation of Agricultural Economics, University of California.

Bauman, D. E., M. J. DeGeeter, C. J. Peel, G. M. Lanza, R. C. Gorewit, and R. W. Hammond
1982 "Effect of Recombinantly-Derived Bovine Growth Hormone (bGH) on Lactational Performance of High Yielding Dairy Cows." **Journal of Dairy Science** 65 (Supplement 1).

Beale, C. L.
1981 "Appendix: A Characterization of Types of Nonmetropolitan Areas." Pp. 54-71 in A. H. Hawley and S. M. Mazie (eds.), **Nonmetropolitan America in Transition.** Chapel Hill: University of North Carolina Press.

Boynton, R. D., A. M. Novakovic, and R. D. Alpin
1984 "Economic Opportunities for the Dairy Industry." New York State Agriculture 2000 Project, November.

Bradshaw, Ted K., and E. J. Blakely
1983 "New Challenges and Opportunities for Rural Development: The Rural Development Policy Project." **The Rural Sociologist** 3:145-154.

Brown, D. L., and C. L. Beale
1981 "Diversity in Post-1970 Population Trends." Pp. 27-71 in A. H. Hawley and S. M. Mazie (eds.), **Nonmetropolitan America in Transition.** Chapel Hill: University of North Carolina Press.

Brunner, E. deS., G. S. Hughes, and M. Patten
1927 **American Agricultural Villages.** New York: George H. Duran Co.

Brunner, E. deS., and J. H. Kolb
1933 **Rural Social Trends.** New York: McGraw-Hill.

Brunner, E. deS., and I. Lorge
1937 **Rural Trends in Depression Years.** New York: Columbia University Press.

Buttel, F. H.

1982a "Farm Structure and Rural Development." Pp. 213-35 in W. P. Browne and D. F. Hadwiger (eds.), **Rural Policy Problems.** Lexington, Mass.: Lexington Books.

1982b "The Political Economy of Part-Time Farming." **GeoJournal** 6 (No. 4):293-300.

1983a "Farm Structure and the Quality of Life in Agricultural Communities: A Review of Literature and a Look Toward the Future." Pp. 150-173 in **Agricultural Communities: The Interrelationship of Agriculture, Business, Industry, and Government in the Rural Economy.** Committee Print prepared by the Congressional Research Service, Library of Congress, for the Committee on Agriculture, U.S. House of Representatives, 98th Congress, 1st Session. Washington, D.C.: U.S. Government Printing Office.

1983b "Beyond the Family Farm." Pp. 87-107 in G. F. Summers (ed.), **Technology and Social Change in Rural Areas.** Boulder, Colo.: Westview Press.

1984 "Agricultural Land Reform in America." Pp. 55-72 in C. C. Geisler and F. R. Popper (eds.), **Land Reform, American Style.** Totowa, N.J.: Rowman and Allanheld.

Buttel, F. H., and M. E. Gertler

1982 "Small Farm Businesses: A Typology of Farm, Operator, and Family Characteristics With Implications for Public Research and Extension Policy." **Journal of the Northeastern Agricultural Economics Council** 11 (Spring):35-44.

Campbell, R. R.

1975 "Beyond the Suburbs: The Changing Rural Scene." Pp. 93-122 in A. H. Hawley and V. P. Rock (eds.), **Metropolitan America in Contemporary Perspective.** Beverly Hills, Cal.: Sage Publications.

Cochrane, W. W.

1979 **The Development of American Agriculture.** Minneapolis: University of Minnesota Press.

Dorner, P.

1983 "Technology and U.S. Agriculture." Pp. 73-86 in G. F. Summers (ed.), **Technology and Social Change in Rural Areas.** Boulder, Colo.: Westview Press.

Eberts, P. R.

1984 **Socioeconomic Trends in Rural New York State.** Albany: New York State Legislative Commission on Rural Resources.

Ebling, W.
1979 **The Fruited Plain: The Story of American Agriculture.** Berkeley: University of California Press.

Edwards, E. E.
1940 "American Agriculture--The First 300 Years." Pp. 171-276 in **Farmers in a Changing World: Yearbook of Agriculture, 1940.** Washington, D.C.: U.S. Department of Agriculture.

Fitchen, J. M.
1981 **Poverty in Rural America.** Boulder, Colo.: Westview Press.

Flora, J. L., and J. L. Conboy
1977 "Impact of Type of Agriculture on Class Structure, Social Well-Being, and Inequities." Paper presented at the annual meeting of the Rural Sociological Society, Madison, Wisconsin.

Forste, R. H., and G. E. Frick
1979 "Dairy." Pp. 119-147 in L. Schertz et al., **Another Revolution in U.S. Farming?** Washington, D.C.: U.S. Department of Agriculture.

Gates, P. W.
1960 **The Farmer's Age: Agriculture, 1815-1860.** New York: Holt, Rinehart, and Winston.

Goldschmidt, W.
1978 **As You Sow.** Montclair, N.J.: Allanheld, Osman & Co.

Gregor, H. F.
1982 **Industrialization of U.S. Agriculture.** Boulder, Colo.: Westview Press.

Hardy, Donald F. II.
1983 "Federal Assistance for Rural Development: The Train That Passed in the Night?" **The Rural Sociologist** 3:392-398.

Harris, C. K., and J. Gilbert
1982 "Large-scale farming, Rural Income, and Goldschmidt's Agrarian Thesis." **Rural Sociology,** 47 (Fall):449-458.

Hastings, S. E., and J. D. White
1984 **Employment Growth in the Northeast: 1970-79.** Bulletin No. 445. Newark, DE: Agricultural Experiment Station, University of Delaware

Hayes, M. N., and A. L. Olmstead
1984 "Farm Size and Community Quality: Arvin and Dinuba Revisited." **American Journal of Agricultural Economics** 66 (November):430-436.

Hedrick, U. P.
1933 **A History of Agriculture in the State of New York.** Albany: J. B. Lyon.

Heffernan, W. D.
1982 "Structure of Agriculture and the Quality of Life in Rural Communities." Pp. 337-346 in D. A. Dillman and D. J. Hobbs (eds.), **Rural Society in the U.S.** Boulder, Colo.: Westview Press.

Herman, C.
1979 "Regionalism and Development: A Socio-History of New York, 1835-1875." Unpublished Ph.D. Dissertation, Cornell University.

Hines, F. K., D. L. Brown, and J. M. Zimmer
1975 **Social and Economic Characteristics of the Population in Metropolitan and Nonmetropolitan Counties, 1970.** Agricultural Economic Report 272. Washington, D.C.: Economic Research Service, U.S. Department of Agriculture.

How, R. B.
1980 "Changes in the Structure of Fruit and Vegetable Farms in the Northeast." Pp. 358-363 in **Farm Structure: A Historical Perspective on Changes in the Number and Size of Farms.** Committee Print, Committee on Agriculture, Nutrition, and Forestry, U. S. Senate, 96th Congress, 2d Session. Washington, D.C.: U.S. Government Printing Office.

Jacobson, R. E.
1980 "Changing Structure of Dairy Farming in the United States: 1940-79." Pp. 127-156 in **Farm Structure: A Historical Perspective on Changes in the Number and Size of Farms.** Committee Print, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, 96th Congress, 2d Session. Washington, D.C.: U.S. Government Printing Office.

Kalter, R. J., et al., Cornell University Center for Biotechnology
1984 "Biotechnology and the Dairy Industry: Production Costs and Commercial Potential of the Bovine Growth Hormone." **A. E. Research** 84-22, December.

Kolb, J. H., and E. deS. Brunner
1952 **A Study of Rural Society.** Fourth Edition. Boston: Houghton Mifflin.

Larson, O. F.
1981 "Agriculture and the Community." Pp. 147-193 in A. H. Hawley and S. M. Mazie (eds.), **Nonmetropolitan America in Transition.** Chapel Hill: University of North Carolina Press.

Lockridge, K. A.
1970 **A New England Town: The First Hundred Years.** New York: W. W. Norton.

MacCannell, D., and J. White
1984 "The Social Costs of Large-Scale Agriculture: The Prospects of Land Reform in California." Pp. 35-54 in C. C. Geisler and F. R. Popper (eds.), **Land Reform, American Style.** Totowa, N.J.: Rowman and Allanheld.

MacLeisch, K., and K. Young
1942 **Culture of a Contemporary Rural Community: Landaff, New Hampshire.** Rural Life Studies No. 3. Washington, D.C.: Bureau of Agricultural Economics, U.S. Department of Agriculture.

Main, J. T.
1965 **The Social Structure of Revolutionary America.** Princeton, N.J.: Princeton University Press.

Office of Technology Assessment, U.S. Congress Unpublished manuscript.
1984a "Summary of Technology Papers." Washington, D.C.: Office of Technology Assessment.

1984b "Agricultural Structure Group: Synopsis." Unpublished manuscript. Washington, D.C.: Office of Technology Assessment.

1985a "Information on the Size Distribution of Farms." Unpublished manuscript. Washington, D.C.: Office of Technology Assessment.

1985b "Technology, Public Policy, and the Changing Structure of American Agriculture: A Special Report for the 1985 Farm Bill." Unpublished manuscript. Washington, D.C.: Office of Technology Assessment.

Raper, A. F.
1949a "The Dairy Areas." Pp. 413-433 in C. C. Taylor et al., **Rural Life in the United States.** New York: Knopf.

1949b "The General and Self-Sufficing Areas." Pp. 446-463 in C. C. Taylor et al., **Rural Life in the United States.** New York: Knopf.

Richardson, J.L., and O. F. Larson
1976 "Small Community Trends: A 50-Year perspective on Social Economic Change in 13 New York Communities." **Rural Sociology** 41 (Spring):45-59.

Rodefeld, R. D.
1980 "Farm Structural Characteristics: Recent Trends, Causes, Implications, and Research Needs--Exerpts." Part III in L. Tweeten et al. (eds.), in **Structure of Agriculture and Information Needs Regarding Small Farms.** Washington, D.C.: National Rural Center.

Schertz, L. P.
1979 "The Northeast." Pp. 257-276 in L. P. Schertz et al., **Another Revolution in U.S. Farming?** Washington, D.C.: U.S. Department of Agriculture.

L. P. Schertz and Others
1979 **Another Revolution in U.S. Farming?** Washington, D.C.: U.S. Department of Agriculture.

Shannon, F. A.
1945 **The Farmer's Last Frontier: Agriculture, 1860-1897.** New York: Holt, Rinehart, and Winston.

Shover, J. L.
1976 **First Majority—Last Minority.** DeKalb: Northern Illinois University Press.

Smith, T. L., and P. E. Zopf, Jr.
1970 **Principles of Inductive Rural-Urban Sociology.** Philadelphia: F. A. Davis Co.

Stanton, B. F.
1984 "Changes in Farm Structure: . The United States and New York, 1930-1982." Cornell Agricultural Economics Staff Paper No. 84-23, Department of Agricultural Economics, Cornell University, September.

Stanton, B. F., and L. M. Plimpton
1979 "People, Land, and Farms: 125 Years of Change in the Northeast." Department of Agricultural Economics, Cornell University.

Summer, G. F. et al.
1976 **Industrial Invasion of Nonmetropolitan America.** New York: Praeger.

Swanson, L. E., Jr.
1982 "Farm and Trade Center Transition in an Industrial Society: Pennsylvania, 1930-1960." Unpublished Ph.D. Dissertation, Pennsylvania State University.

Taylor, C. C. et al.
1949 **Rural Life in the United States.** New York: Knopf.

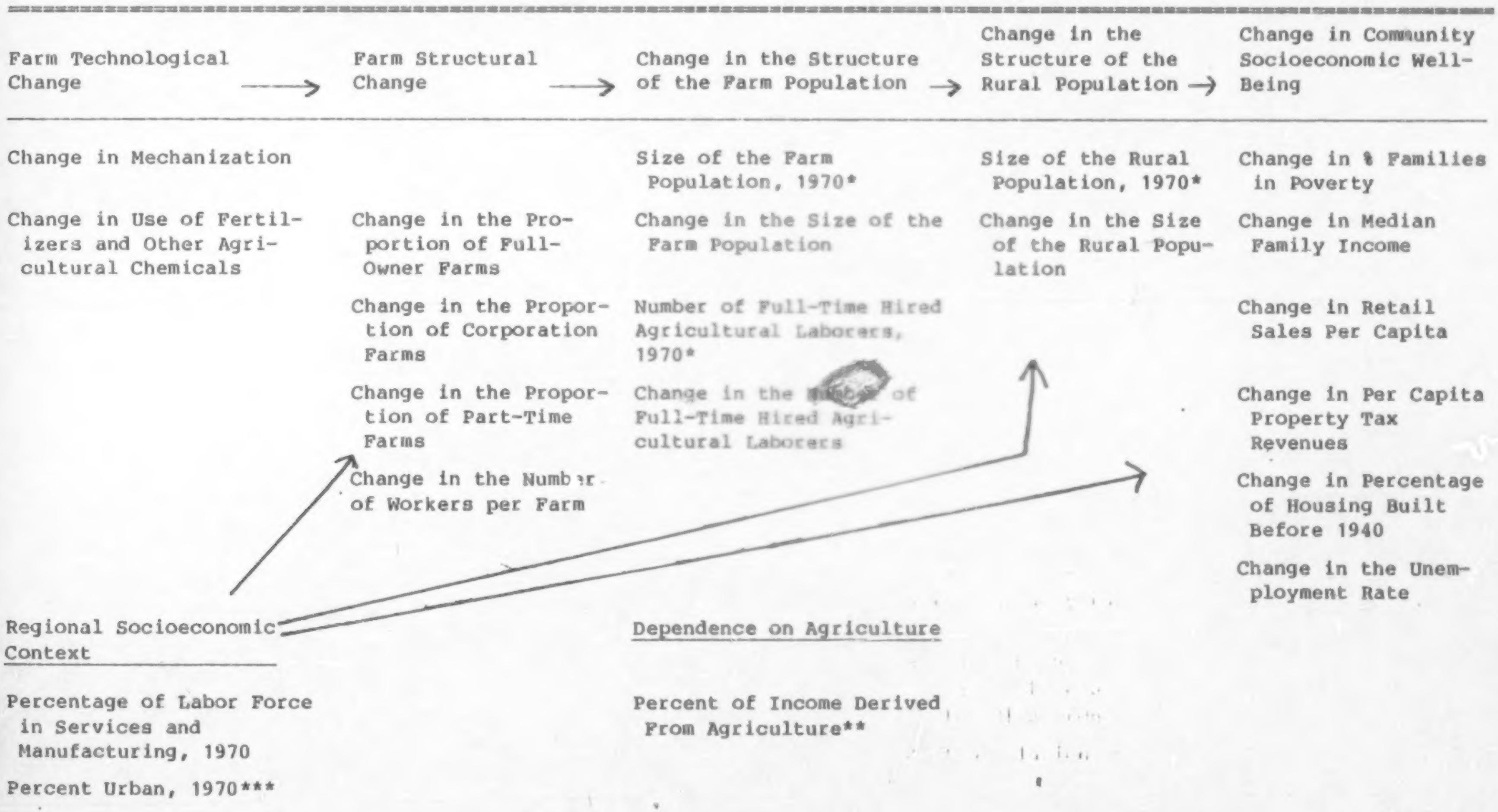
Tostlebe, A. S.
1957 **Capital in Agriculture: Its Formation and Financing Since 1870.** Princeton, N.J.: Princeton University Press.

Tweeten, L., and W. Huffman
1980 "Structural Change." Part I in L. Tweeten et al. (eds.), **Structure of Agriculture and Information Needs Regarding Small Farms.** Washington, D.C.: National Rural Center.

Wilkinson, Kenneth P., D. J. Hobbs, and J. A. Christenson
1983 "An Analysis of the National Rural Development Strategy." **The Rural Sociologist** 3:384-391.

Young, R. C.
1984 "Industrial Location and Regional Change in New York State." Unpublished manuscript, Department of Rural Sociology, Cornell University.

FIGURE 1. A Model of Technological, Farm Structural, and Rural Community Change in the Northeast, 1969/70 to 1978/80


Farm Technological Change
Farm Structural Change
Change in the Structure of the Farm Population
Change in the Structure of the Rural Population
Change in Community Socioeconomic Well-Being
Change in Mechanization
Change in Use of Fertilizers and Other Agricultural Chemicals
Change in the Proportion of Full-Owner Farms
Change in the Proportion of Corporation Farms
Change in the Proportion of Part-Time Farms
Change in the Number of Workers per Farm
Size of the Farm Population, 1970*
Change in the Size of the Farm Population
Number of Full-Time Hired Agricultural Laborers, 1970*
Change in the Number of Full-Time Hired Agricultural Laborers
Size of the Rural Population, 1970*
Change in the Size of the Rural Population
Change in % Families in Poverty
Change in Median Family Income
Change in Retail Sales Per Capita
Change in Per Capita Property Tax Revenues
Change in Percentage of Housing Built Before 1940
Change in the Unemployment Rate
Regional Socioeconomic Context
Percentage of Labor Force in Services and Manufacturing, 1970
Percent Urban, 1970***
Dependence on Agriculture
Percent of Income Derived From Agriculture**

*Indicates that the variable is utilized only as an independent variable. The procedure of using both the 1970 level and the 1970-1980 rate of change as independent variables is utilized when it is likely that the rate of change and the initial level may have distinct causal effects.

**Equations will be computed among the total population of nonmetropolitan counties and among the subpopulation of nonmetropolitan counties in which 5 percent or more of income was derived from agriculture according to the 1975-1979 average annual percentage of labor and proprietor income derived from agricultural sources.

***The percent urban variable is deleted when change in the size of the rural population and indicators of change in community socioeconomic well-being are regressed on antecedent variables.

TABLE 1. Numbers of Farms By Selected Characteristics 1974 and 1982, and Percent Change, 1974-82, Nine Northeastern States and U.S.

Farm Structure Characteristics	Northeast Region 1974	Northeast Region 1982	Percent Change, 1974-82	U.S. 1974	U.S. 1982	Percent Change, 1974-82
Number of Farms	127,531	131,991	3.5	2,314,013	2,241,124	-0.3
Land in Farms (acres)	23,359,889	23,061,163	-1.3	1,017,030,357	984,755,115	-0.3
Aver. Size of Farm	183	175	-4.4	440	439	-0.1
Value of Land & Bldgs.						
Average per Farm	121,227	214,623	77.0	147,838	347,974	135.2
Average per Acre	662	1,236	86.7	336	791	135.4
Farms by Size						
Less than 10 Acres	7,689	10,599	37.8	128,254	187,699	46.3
10-49 Acres	19,416	26,421	36.1	379,543	449,301	18.3
50-179 Acres	54,901	51,866	-5.5	827,884	711,701	-14.0
180-499 Acres	37,864	34,533	-8.8	616,098	526,566	-14.5
500-999 Acres	6,421	7,070	10.1	207,297	203,936	-1.5
1,000-1,999 Acres	1,046	1,282	22.5	92,712	97,396	5.1
≥2,000 Acres	194	220	13.4	62,225	64,525	3.7
Land Use						
Total Cropland	13,851,473	13,972,802	0.8	440,039,087	445,527,557	1.2
Woodland	5,809,958	5,899,750	1.5	92,527,627	87,133,026	-5.8
Agricultural Products Sold						
Market Value ($1,000)	4,291,380	7,179,543	67.3	81,526,124	131,810,903	61.6
Average per Farm	33,650	54,394	61.6	35,231	58,815	66.9
Crops	1,440,397	2,181,303	51.4	41,790,360	62,274,394	49.0
Livestock	2,216,436	4,998,240	125.5	33,301,560	69,536,509	108.8
Poultry	616,094	844,395	37.1	6,202,291	9,732,222	56.9
Farms by Type of Organization						
Individual or Family	82,142**	115,713	40.9	1,517,573**	1,945,724	28.2
Corporation	2,615**	4,098	56.7	28,656**	59,788	108.6
Tenure of Operator						
Full Owner	83,389	82,043	-1.6	1,423,953	1,325,931	-6.9
Part Owner	36,112	40,005	10.8	628,224	656,219	4.5
Tenant	8,030	9,943	23.8	261,836	258,974	-1.1
Principal Occupation						
Farming	78,144	75,111	-3.8	1,427,368	1,234,858	-13.4
Nonfarming	46,390	56,442	21.5	851,902	1,006,266	18.1
Operators Reporting Any Days of Work Off Farm						
Any	56,670	67,751	19.6	1,011,476	1,187,490	17.4
≥100 Days	46,691	56,048	20.0	814,555	963,728	18.3

Continued

TABLE 1 (continued)

Farm Structure Characteristics	Northeast Region		Percent Change, 1974-82	U.S.		Percent Change, 1974-82
	1974	1982		1974	1982	
Selected Production Expenses ($1,000)						
Commercial Fertilizer	207,433	309,769	49.3	5,137,361	7,669,577	49.7
Other Agric. Chemicals	74,225	140,301	89.0	1,757,776	4,282,795	143.6
Hired Labor	401,846	712,383	77.3	4,652,074	8,434,399	81.3
Workers Working >150 Days:Farms	21,775**	29,242	34.3	223,093**	312,621	40.1
Numbers of Workers*	66,149	88,547	33.9	712,715**	950,112	33.3
Machinery and Equipment						
Estimated Value($1,000)	2,879,414	5,337,081	85.4	48,402,626	93,686,308	93.6
Average per Farm	23,470	40,435	72.3	22,303	41,930	88.0

*Computed from the preliminary reports for the nine Northeast states.

**Among farms with sales >$2,500.

SOURCES: 1974 data: 1978 Census of Agriculture: Preliminary Report (Northeast Region and United States) (Washington, D.C.., Bureau of the Census, U.S. Department of Commerce, 1980); 1982 data: 1982 Census of Agriculture: Preliminary Report (nine Northeastern states and United States) (Washington, D.C.: Bureau of the Census, U.S. Department of Commerce, 1983).

TABLE 2. Farm Structure Indicators: Northeast Region and United States, 1982

Farm Structure Indicators	Northeast	U.S.
Average Size of Farm (Acres)	175	439
Average Value of Land and Buildings per Farm	$214,623	$347,974
Average Value of Land and Buildings per Acre	1,236	791
Percent Distribution of Farms by Acreage		
<10	8.0%	8.4%
10-49	20.0	20.0
50-179	39.3	31.8
180-499	26.2	23.5
500-999	5.4	9.1
1,000-1,999	1.0	4.3
≥2,000	0.2	2.9
Percent Distribution of Farms by Type of Organization		
Individual or Family	87.7%	86.8%
Corporation		
Family-held	2.7	2.3
Other Than Family Held	0.4	0.3
Percent Distribution of Farms by Tenure of Operator		
Full Owner	62.2%	59.2%
Part Owner	30.3	29.3
Tenant	7.5	11.6
Percent Distribution of Farms by Principal Occupation of Operator		
Farming	56.9%	55.1%
Nonfarming	42.8	44.9
Percent of Farm Operators Reporting Any Days of Work Off Farm	51.3%	53.0%
Percent of Farm Operators Reporting ≥10 Days of Work Off Farm	42.5%	43.0%

Continued

TABLE 2 (continued)

Farm Structure Indicators	Northeast	U.S.
Average Market Value of Agricultural Products Sold per Farm ($)	$54,394	$58,815
Percent Distribution of Farms by Value of Sales		
≥$250,000	3.6%	3.9%
$100,000-249,999	11.2	9.6
$40,00-99,999	16.9	14.9
$20,000-39,999	8.9	11.1
$10,000-19,999	9.1	11.6
$5,000-9,999	11.2	12.6
<$5,000	39.1	36.4
$ Commercial Fertilizer/Acre of Cropland	$22.2	$17.25
$ Other Agricultural Chemicals/Acre of Cropland	$10.0	$9.6
$ Hired Labor as Percent of Cultural Products Sold	9.9%	6.4%
Percent of Farms With Workers Working ≥150 Days	22.2	13.9
Workers/Farm	3.03	3.04
Estimated Value of Machinery and Equipment/Farm	$40,435	$41,930
Sales of Crops as Percent of Market Value of Agricultural Products Sold	30.4%	47.2%
Sales of Livestock as Percent of Market Value of Agricultural Products Sold	69.6	52.8
Sales of Dairy Products as Percent of Market Value of Agricultural Products Sold	44.0	12.4
Sales of Poultry as Percent of Market Value of Agricultural Products Sold	11.8	7.4

Table 3. A Typology of New York State Rural Counties Based on Extent of Urban Influence.*

		Size of Largest Place in County (10,000 or More Persons)		
		Higher than 10,000	Lower than 10,000	
Percentage of Work Force Which Commutes Outside County of Residence for Employment	Higher (20% or more)	3. Extensive Urban Influence Cayuga Fulton Genesee Madison Montgomery Ontario Oswego Rensselaer Saratoga Schenectady Wayne (N = 11)	5. Moderate Urban Influence Columbia Greene Hamilton Herkimer Livingston Orleans Putnam Schoharie Schuyler Seneca Tioga Washington Wyoming Yates (N = 14)	(N = 25)
	Lower (19.9% or less)	4. Considerable Urban Influence Cattaraugus Chautauqua Chemung Clinton Cortland Jefferson Otsego St. Lawrence Steuben Tompkins Ulster Warren (N = 12)	6. Limited Urban Influence Allegany Chenango Delaware Essex Franklin Lewis Sullivan (N = 7)	(N = 19)
		(N = 23)	(N = 21)	Total N = 44

*Urban influence is defined here as a function of size of largest municipality in a county and the percentage of the county's work force which commutes outside the county for employment.

SOURCE: Eberts (1984:11).

Table 4. Population Size in County Types 1-6, New York State, 1950-1980*

County Type	1950	1960	1970	1980
Metropolitan				
1	9,555,943	10,694,633	11,575,740	10,803,581
2	2,854,556	3,426,102	3,759,542	3,666,665
Rural				
3	819,198	897,869	1,002,047	1,056,098
4	908,265	1,015,782	1,073,587	1,120,642
5	421,720	468,594	538,145	591,881
6	270,510	279,324	292,330	319,205

*SOURCE: Eberts (1984). For tables 10-22, taken from Eberts (1984:122-36), metropolitan county types 1 and 2 are, respectively, the downstate and upstat metro county types (see the definitions in the text), while the rural county types 3 through six are, respectively, the rural counties with extensive, considerable, moderate, and limited urban influence (see Table 9 and the text).

Table 5. Tertiary (Service) Sector Employment as a Percentage of Work Force in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	72.3	73.7	80.6	82.0
2	59.0	62.1	68.1	71.9
Rural				
3	52.0	58.2	66.1	70.0
4	56.9	61.0	68.4	70.4
5	51.8	57.0	63.2	66.5
6	57.4	62.6	70.2	71.2

Table 6. Secondary Sector Employment as a Percentage of Work Force in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	27.2	25.8	19.0	17.5
2	37.8	36.0	30.6	27.0
Rural				
3	38.9	35.6	30.3	26.9
4	29.4	30.7	26.3	25.0
5	29.3	31.6	29.9	27.5
6	18.8	21.5	20.8	21.7

Table 7. Total Number of Manufacturing Units Employing 100 or More Persons in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	1,526	1,815	1,744	1,475
2	727	661	601	589
Rural				
3	185	198	180	164
4	204	193	204	202
5	94	93	95	85
6	33	34	38	46

Table 8. Primary Sector Employment as a Percentage of Work Force in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	0.6	0.5	0.4	0.5
2	3.2	1.9	1.3	1.1
Rural				
3	9.1	6.1	3.5	3.1
4	13.7	8.4	5.3	4.6
5	18.8	11.4	6.9	6.0
6	23.8	15.9	9.0	7.1

Table 9. Average Percentage of Land in Agriculture in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	15.9	9.5	6.1	4.6
2	60.3	48.6	35.6	32.4
Rural				
3	58.6	54.7	42.3	40.3
4	57.2	48.2	36.3	33.8
5	50.9	44.1	35.1	33.7
6	41.2	35.1	25.1	22.7

Table 10. Total Number of Farms in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	4,185	2,043	1,030	1,116
2	26,919	16,807	10,350	8,198
Rural				
3	23,415	16,076	10,111	8,098
4	34,199	23,049	14,479	12,242
5	20,920	14,159	9,560	8,154
6	15,339	10,240	6,379	5,267

Table 11. Total Acres Harvested in Agriculture in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	21,714	13,017	8,302	6,293
2	276,542	222,958	163,481	148,814
Rural				
3	250,240	233,641	180,877	172,207
4	488,099	411,663	309,643	288,491
5	297,558	257,975	205,265	196,881
6	242,835	207,069	147,641	133,564

Table 12. Total Market Value of Agricultural Products Sold (Thousands of Dollars Adjusted to 1980 Dollars) in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	213,278	176,965	162,013	114,282
2	514,653	491,929	478,297	438,353
Rural				
3	413,167	448,578	444,486	447,462
4	563,705	584,201	622,148	606,962
5	660,799	508,918	484,246	482,364
6	300,023	283,560	331,788	292,352

Table 13. Median Family Income Adjusted to 1980 Dollars by the Consumer Price Index in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	12,610	18,525	24,527	23,192
2	12,096	18,384	24,543	24,402
Rural				
3	11,178	16,297	22,484	22,245
4	10,229	15,581	20,360	19,863
5	9,653	15,318	21,650	21,565
6	9,011	13,973	19,161	18,248

Table 14. Percentage of Persons Aged 25 and Over Who Have Completed Some College or More in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	13.6	17.5	21.5	33.0
2	12.4	16.3	22.3	32.8
Rural				
3	12.6	14.6	19.4	28.9
4	13.3	15.6	21.6	29.8
5	11.4	13.5	18.6	26.9
6	13.0	14.7	19.2	26.5

Table 15. Percentage of Labor Force Unemployed
in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	5.9	4.0	3.1	6.3
2	5.4	5.0	3.6	7.1
Rural				
3	5.2	6.9	4.5	8.5
4	5.5	6.8	4.7	8.9
5	5.7	6.4	4.2	8.9
6	6.6	8.4	5.4	10.0

Table 16. Percentage of Families in Poverty
in County Types 1-6, New York State, 1950-1980

County Type	1950	1960	1970	1980
Metropolitan				
1	18.4	13.2	12.8	16.3
2	17.5	12.3	10.0	10.6
Rural				
3	22.6	16.7	11.1	11.2
4	27.7	18.6	14.0	14.2
5	31.2	18.8	12.5	12.0
6	34.2	24.4	16.3	16.0

TABLE 17. DESCRIPTIONS OF VARIABLES USED IN THE ANALYSIS

NFEMPLOY measures the percentage of total 1970 employment in a county for which employment in the manufacture of durable and nondurable goods and employment in "selected services" accounted.

URBAN measures the percentage of the total 1970 population in a county which resided in urbanized areas or places with 2500 or more people.

MACHINERY measures the difference between the average value of machinery and equipment per farm between 1969 and 1978. It is measured in current dollars.

CHEMICALS measures change in the ratio between expenditures for fertilizer and agricultural chemicals and total agricultural sales in a county for the years 1969 and 1978. It is measured as change in the ratio of current dollars. We consider this to be a better measure of the "flow" of chemical inputs than an expenditure-per-farm measure.

SALES measures the percentage change in total gross farm sales for a county between 1969 and 1978. It is considered to be an indicator of differences in the quality of agricultural resources and change in the well-being of the local farm economy.

CORPORATE measures change in the percentage of all farms in a county which were operated under an incorporated form of ownership in 1969 and 1978.

FULLOWN measures change between 1969 and 1978 in the percentage of farms with sales of $2500 or more per year which are fully owned by the operating entity. The Census of Agriculture distinguishes between farms on which an operator owns all of the land in the operation, those which are partly owned and partly rented, and those on which all of the land is rented (tenant farms).

PART-TIME measures change between 1969 and 1978 in the percentage of farm operators who reported 100 or more days of off-farm employment.

WORKERS measures change in the number of regularly employed hired farm workers between 1969 and 1978. The Census of Agriculture distinguished a category of hired workers who have been employed for 150 or more days during the preceding year. Although this category includes many workers who are not actually employed full-time, year-round, we consider this category to include "regularly" employed farm workers, as compared to those who are employed on a casual or seasonal basis only. In the 1969 Census of Agriculture this category included only workers who were employed on farms with $2500 or more in agricultural sales, while the 1978 data file includes workers who were employed on all farms. The differences in the numbers of workers between 1969 and 1978 are likely to be somewhat artificially inflated due to the different method of reporting. However, the difference in method applies to all counties, and regularly employed workers in 1969 were employed predominantly on farms with sales greater than $2500, so we expect that the possibility of systemmatic bias is minimal.

WORKFARM measures change in the number of regularly employed hired workers per farm reporting hired labor expenditures. it is considered to be an indicator of change in the composition of the farm labor force.

FARMPOP measures change in the size of a county's farm population between 1970 and 1980. The definition of a farm changed during this interval, but we have no reason to expect that this change will systematically bias the results of our analysis.

RURALPOP measures change in the size of the total rural population of a county between 1970 and 1980.

RURALPOP% measures change in the percentage of a county's population which is classified as rural.

POVERTY measures change between 1970 and 1980 in the percentage of all families in a county which had below-poverty level incomes.

INCOME measures the difference in median family incomes for a county between 1970 and 1980. It is measured in current dollars.

RETAIL measures change in retail sales per capita for a county between 1967 and 1977. Total retail sales figures are available from the Censuses of Retail Trade for those years. The base population figures for computing per capita sales are the total county populations for 1970 and 1980, derived from the Censuses of Population for those years. All of the data are included in the data files for the County-City Data Book, 1972 and 1983.

HOUSING measures change in the percentage of housing units in buildings built before 1940. Change in the percentage of "old" housing units within a county between 1970 and 1980 was affected by the removal of old housing units from the total stock of available housing, and by the addition of new housing units built during the interval. The percentage of occupied housing units in 1970 which were built before 1940 was not available from the County-City Data Book data files. Thus, the number of pre-1940 housing units for 1980 was divided by the total number of occupied housing units in 1970 to obtain a measure for 1970. This does not take into account the removal of old housing stock, but the difference in percentages still serves as an indicator of the level of improvement in the total housing stock.

TAXES measures changes in the average per capita property taxes paid by county residents between 1967 and 1977.

UNEMPLOY measures change in the unemployment rate between 1970 and 1980.

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* Data were obtained from the data files for the County-City Data Book, 1972 and 1983 editions, for NFEMPLOY, URBAN, FARMPOP, FARMPOP%, RURALPOP, RURALPOP%, POVERTY, INCOME, RETAIL, HOUSING, TAXES, and UNEMPLOY.

** Data were obtained from the U.S. Census of Agriculture, 1969 and 1978, for MACHINERY, CHEMICALS, SALES, CORPORATE, FULLOWN, PART-TIME, WORKFARM, and WORKERS.

TABLE 18. PERCENTAGE OF LABOR-PROPRIETOR INCOME DERIVED FROM AGRICULTURE, FIVE-YEAR AVERAGE, 1975-1979, NONMETROPOLITAN COUNTIES IN THE NORTHEAST

Percent of Total Income	Number of Counties	Percent of Counties
Under 1	21	20.0
1.00-2.99	38	36.2
3.00-4.99	16	15.2
5.00 or more	30	28.6
TOTAL	105	100.0

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

TABLE 19. ALL VARIABLES INCLUDED IN THE ANALYSIS: MEANS, STANDARD DEVIATIONS, AND RANGE, FOR ALL NONMETROPOLITAN AND FOR AGRICULTURAL COUNTIES IN THE NORTHEAST

	County Type							
	All Nonmetropolitan				Agricultural			
Variables	Mean	S.D.	MIN	MAX	MEAN	S.D.	MIN	MAX
Farm Characteristics								
MACHINERY	19,863.39	7,142.20	5,096	36,907	25,178.57	5,330.72	16,927	36,907
CHEMICALS	1.59	1.81	-3.96	9.57	1.24	1.61	-3.96	5.48
SALES	.96	.55	-.19	4.62	1.19	.72	.42	4.62
CORPORATE	1.24	2.82	-18.89	11.11	1.41	1.21	-1.23	4.47
FULLOWN	-8.62	8.96	-54.44	26.98	-11.64	4.86	-26.14	-4.43
PART-TIME	1.04	6.42	-32.14	11.72	-0.56	5.13	-18.08	7.38
WORKFARM	.52	.47	-1.11	3.08	.65	.48	.18	3.08
Population								
FARMPOP	-706.68	745.52	-5,066	113	-990.53	720.64	-3,603	89
FARMPOP%	-.02	.02	-.11	.01	-.04	.02	-.11	.00
WORKERS	87.59	152.51	-696	807	168.50	155.03	-100	807
RURALPOP	4,907.73	6,213.98	-21,796	39,757	3,754.17	2,212.45	-451	9,773
RURALPOP%	.02	.06	-.28	.17	.02	.05	-.19	.17
Community								
POVERTY	-0.58	1.99	-7.50	4.07	-0.44	1.67	-4.24	4.07
INCOME	8,595.13	1,479.69	5,285	15,282	7,856.70	1,065.40	5,285	10,675
RETAIL	1,415.58	522.83	169.21	4,396.08	1,075.77	320.11	169.21	1,783.95
HOUSING	-11.82	5.63	-42.57	14.63	-12.32	3.60	-18.04	-5.70
TAXES	129.61	86.79	-156.00	408.00	108.90	60.54	6	233
UNEMPLOY	3.72	1.85	-.56	9.62	3.89	1.90	1.23	9.62
Contextual								
NFEMPLOY	36.90	9.13	18.10	60.70	35.16	7.21	25	52.80
URBAN	29.22	17.44	---	68.00	19.38	13.82	0	50.50

TABLE 20. STANDARDIZED REGRESSION COEFFICIENTS FOR MODELS PREDICTING CHANGE IN FARM STRUCTURAL VARIABLES, 1970-1980, FOR ALL NONMETROPOLITAN AND FOR AGRICULTURAL COUNTIES IN THE NORTHEAST

	Dependent Variables							
	CORPORATE		FULLOWN		PART-TIME		WORKFARM	
Independent Variables[1]	All Nonmetro	Agricultural	All Nonmetro	Agricultural	All Nonmetro	Agricultural	All Nonmetro	Agricultural
TIME 1	-.65**	.47*	-.60**	-.32	-.43**	-.54*	-.15	.15
CHEMICALS	-.18*	-.14	-.12	.29	.26**	.68**	-.32**	-.14
MACHINERY	.06	.26	-.24**	-.19	-.61**	-.41	.10	.04
SALES	-.19*	-.18	.00	.47	.10	.68*	.50**	.83**
NFEMPLOY	-.08	-.25	.03	-.10	.06	-.16	-.02	-.04
URBAN	.22**	.28	.12	.20	.10	.08	.18*	.07
$\bar{R}$-Squared	.61	.38	.44	.01	.27	.16	.49	.69

[1] Each of the dependent variables is measured as a simple gain score between 1969 and 1978, therefore a time-one control variable is introduced in each model. Variables measuring 1969 percentages of corporate farms, fully-owned farms, and part-time farms, and the number of workers per farm in 1969 are included in the CORPORATE, FULLOWN, PART-TIME, AND WORKFARM models, respectively.

* Unstandardized coefficients significant at $p < .05$.

** Unstandardized coefficients significant at $p < .01$.

TABLE 21. FIRST-ORDER AND THIRD-ORDER PARTIAL CORRELATION COEFFICIENTS FOR THE REGRESSION OF CHANGE IN FARM POPULATION CHARACTERISTICS ON SELECTED VARIABLES, FOR ALL NONMETROPOLITAN AND FOR AGRICULTURAL COUNTIES IN THE NORTHEAST[1]

Farm Sector and Contextual Variables	Population Characteristics WORKERS All Nonmetro	 WORKERS Agricultural	 FARMPOP All Nonmetro	 FARMPOP Agricultural	 RURALPOP All Nonmetro	 RURALPOP Agricultural
FARMPOP	--	--	--	--	-.01(-.01)	.20(.17)
WORKERS	--	--	--	--	-.13(-.13)	-.21(-.24)
CORPORATE	.12(.11)	-.03(-.02)	.02(.00)	-.23(-.02)	-.12(-.12)	.24(.30)
FULLOWN	-.11(-.12)	.16(.15)	.07(.02)	.26(.33)	-.06(-.06)	.00(.02)
PART-TIME	-.14(-.14)	.05(.07)	-.13(-.11)	-.05(-.02)	-.19(-.19)	.12(.18)
WORKFARM	.68(.68)	.80(.79)	.12(.08)	.11(.11)	-.10(-.10)	-.23(-.25)
CHEMICALS	-.26(-.26)	-.58(-.57)	.06(.07)	-.08(-.03)	-.08(-.08)	.11(.13)
MACHINERY	.46(.47)	.09(.16)	.21(.22)	.01(.12)	-.03(-.03)	-.45(-.38)
SALES	.58(.59)	.73(.73)	.31(.27)	.33(.26)	-.07(-.06)	-.17(-.21)
NFEMPLOY	-.01 --	.14 --	.20 --	.21 --	-.03 --	.24 --
URBAN	.05 --	.20 --	.07 --	-.19 --	-- --	-- --
N	105	30	105	30	105	30

[1] First-order partials are reported in each column. They represent the correlation between a population change score and a farm sector change score or contextual variable, controlling the initial size of the population. Third-order partials, which control the influence of the urban and nonfarm employment contextual variables in addition to initial size, are reported in parentheses.

TABLE 22. FIRST-ORDER AND THIRD-ORDER PARTIAL CORRELATION COEFFICIENTS FOR THE REGRESSION OF CHANGE IN COMMUNITY WELL-BEING ON SELECTED VARIABLES, ALL NONMETROPOLITAN COUNTIES[1]

Farm Sector and Control Variables	Community Characteristics				
	POVERTY	INCOME	RETAIL	HOUSING	TAXES
RURALPOP%	.02(.07)	.05(-.01)	-.05(-.10)	.16(.03)	-.14(-.07)
FARMPOP%	-.21(-.17)	.20(.14)	.39(.32)	.06(-.10)	-.08(.01)
CORPORATE	.02(.03)	-.03(-.05)	.03(.00)	-.14(-.21)	.05(.06)
FULLOWN	-.25(-.21)	.22(.17)	.20(.15)	.12(.00)	-.06(-.01)
PART-TIME	-.14(-.15)	.24(.26)	.26(.27)	.06(.10)	.14(.12)
WORKFARM	-.08(-.05)	.05(.02)	.00(-.03)	.09(-.01)	-.13(-.10)
SALES	-.08(-.06)	.16(.13)	-.04(-.05)	.23(.17)	-.23(-.19)
NFEMPLOY	-.10 --	.14 --	.09 --	.38 --	-.26 --
URBAN	-.08 --	.12 --	.14 --	.25 --	-.12 --

N=105

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[1] First-order partials are reported in each column. They represent the correlation between a community change score and a farm sector change score or contextual variable, controlling the initial size of the community variable. Third-order partials, which control the influence of the urban and nonfarm employment contextual variables in addition to initial size, are reported in parentheses.

TABLE 23. FIRST-ORDER AND THIRD-ORDER PARTIAL CORRELATION COEFFICIENTS FOR THE REGRESSION OF CHANGE IN COMMUNITY WELL-BEING ON SELECTED VARIABLES, AGRICULTURAL COUNTIES[1]

Farm Sector and Control Variables	Community Characteristics				
	POVERTY	INCOME	RETAIL	HOUSING	TAXES
RURALPOP%	.12(.00)	.00(-.04)	.01(-.08)	.45(.13)	.02(.08)
FARMPOP%	-.10(-.21)	.39(.36)	.48(.40)	.24(-.07)	.14(.11)
CORPORATE	.24(.18)	-.25(-.14)	.18(.22)	-.33(-.45)	.03(-.05)
FULLOWN	-.27(-.29)	.33(.35)	.03(.03)	.13(.13)	-.04(-.07)
PART-TIME	.16(.16)	-.01(.03)	.40(.42)	-.29(-.31)	.19(.12)
WORKFARM	-.43(-.44)	.40(.36)	.34(.32)	.08(.03)	.20(.24)
SALES	-.41(-.40)	.55(.48)	.38(.34)	.04(-.01)	.06(.10)
NFEMPLOY	.06 --	.24 --	.17 --	.39 --	-.23 --
URBAN	.22 --	-.07 --	.08 --	.50 --	.05 --

N=30

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[1] First-order partials are reported in each column. They represent the correlation between a community change score and a farm sector change score or contextual variable, controlling the initial size of the community variable. Third-order partials, which control the influence of the urban and nonfarm employment contextual variables in addition to initial size, are reported in parentheses.

TABLE 24. UNSTANDARDIZED REGRESSION COEFFICIENTS FOR MODELS PREDICTING CHANGE IN SELECTED COMMUNITY CHARACTERISTICS, 1970-1980, FOR ALL NONMETROPOLITAN AND FOR AGRICULTURAL COUNTIES IN THE NORTHEAST

	Dependent Variables									
	POVERTY		INCOME		RETAIL		HOUSING		TAXES	
Independent Variables[1]	All Nonmetro	Agricultural	All Nonmetro	Agricultural	All Nonmetro	Agricultural	All Nonmetro	Agricultural	All Nonmetro	Agricultural
Time 1 Control	-.41*	-.36	.77*	.42	.75*	.39*	-.19*	-.22*	.94*	.94*
RURALPOP%	1.41	--	-262.07	--	37.22	--	3.11	--	-49.12	--
FARMPOP%	-9.42	--	2530.62	11503.17	8417.93*	6544.20*	-1.69	--	132.57	--
CORPORATE	.12	--	-86.34	-179.90	-3.20	--	.07	-1.38*	1.62	--
FULLOWN	-.07*	-.08	60.12*	--	4.94	-14.25	-.01	--	-.46	--
PART-TIME	-.02	--	32.98	--	15.34	18.12*	-.02	-.14	.54	--
WORKFARM	-.13	-1.18*	-375.21	--	24.25	--	-.58	--	4.73	48.96
SALES	-.13	--	585.46	580.32*	-59.09	--	.84	--	-26.61	-26.01
NFEMPLOY	-.01	--	15.67	--	.28	--	.19*	--	-1.58*	-1.97
URBAN	.00	.03	6.14	--	-2.00	--	.03	.17*	-.34	--
INTERCEPT	3.02	2.89	1630.70	4509.67	665.82	701.02	-8.48	.13	109.82	82.96
$\bar{R}$-Squared	.37	.40	.33	.41	.40	.61	.22	.63	.52	.69

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[1] Each dependent variable is measured as a simple gain score over a ten-year period, therefore a time-one control variable is introduced in each model. The poverty level in 1970 is included in the POVERTY model. Median family income in 1969 is included in the INCOME model. Per-capita retail sales in 1967 is included in the RETAIL model. The percentage of housing units built before 1940 which existed in 1970 is included in the HOUSING model. Per capita property taxes in 1967 is included in the TAXES model.

* $p < .05$

Table 25. Potential Impact of Technology Groups on Capital and Labor at the Producer Level, Assuming Adoption, by Animals and Plants, Agricultural Structure Group.

	Potential Additional Change Induced by Technology Group by Year 2000 in		
Area and Technology Group	Capital	Labor	Capital/Labor Ratio
Animal			
Biological Group	Slight decrease (<5%)	Slight decrease (<5%)	No significant Change
Mechanical Group	Moderate Increase (5-10%)	Slight Decrease (<5%)	Moderate Increase (5-10%)
Information Group	Moderate Increase (5-10%)	Slight Increase (<5%)	Moderate Increase (5-10%)
Plant			
Biological Group	No Significant Change	Slight decrease (<5%)	No significant Change
Mechanical Group	Moderate increase (5-10%)	Slight increase (<5%)	No significant Change
Information Group	Moderate increase (5-10%)	Slight increase (<5%)	Moderate increase (5-10%)
Management Techniques Group	Slight increase (<5%)	Moderate increase (5-10%)	Slight increase (<5%)

Source: Office of Technology Assessment, "Synopsis: Agricultural Structure Group."

Table 26. Percent Adoption Rate of At Least One Technology Within a Technology Group By Size of Farm, Year 2000.

Area and Technology Group	Adoption Rate Range, by Sales Size Category (1984 Constant Dollars): Less than $20,000	$20,000-$99,999	$100,000-$499,999	$500,000 or more
	— Percent —			
Animal				
Biological Group	10-20	30-40	60-70	80-90
Mechanical Group	0-10	10-20	40-50	70-80
Information Group	0-10	10-20	55-65	80-90
Plant				
Biological Group	40-50	60-70	85-95	90-100
Mechanical Group	0-10	10-20	40-50	70-80
Information Group	0-10	15-25	55-65	75-85
Management Techniques	10-20	30-40	55-65	70-80

Source: Office of Technology Assessment, "Synopsis: Agricultural Structure Group."

Table 27. Potential Directional Impact of Technology Groups on Structural Elements at the Producer Level, by Animals and Plants, Agricultural Structure Group.

Area and Technology Group	Potential Additional Change Induced by Technology Group by Year 2000 in		
	Vertical Coordination and Control	Market Access	Barriers to Entry
Animal			
Biological Group	Closer Coordination Encouraged	Slight Reduction	no significant Change
Mechanical Group	No Significant Change	No Significant Change	No Significant Change
Information Group	No Significant Change	Slight Increase	Slight to Definite Reduction
Plant			
Biological Group	Slight Encouragement of Closer Coordination	no significant Change	no significant Change
Mechanical Group	No Significant Change	no significant Change	slight increase
Information Group	No Significant Change	Increase	no significant Change
Management Techniques Group	No Significant Change	no significant change	slight to moderate increase

Source: Office of Technology Assessment, "Synopsis: Agricultural Structure Group."

Table 28. Size Distribution of Total Farms in the Northeast and U.S. in Year 2000: Three Scenarios*

Dollar Sales Category (Annual)	Size Distribution Scenario 1 N.E.	Scenario 1 U.S.	Scenario 2 N.E.	Scenario 2 U.S.	Scenario 3 N.E.	Scenario 3 U.S.
($1,000)			(percent)			
>$500	6.7	3.6	16.8	11.6	4.9	2.7
100-499	20.2	16.0	10.1	8.0	16.8	12.9
20-99	26.9	29.1	20.1	21.8	32.1	33.1
<20	46.2	51.3	53.0	58.6	46.2	51.3

* Scenario 1: continuation of current policies
Scenario 2: policies implemented to speed move to bimodal size distribution
Scenario 3: policies implemented to slow trend to larger farm size.

Derived from OTA "Information on Size Distribution of Farms."

Table 29. Changes in Size Distribution of Farms in Northeast and U.S. in Response to Policy Changes*

Dollar Sales Category (Annual)	Changes in Size Distribution			
	Scenario 1 to 2		Scenario 1 to 3	
	N.E.	U.S.	N.E.	U.S.
($1,000)	(percent change from Scenario 1)			
>$500	+10.1	+8.0	-1.8	-.9
100-499	-10.1	-8.0	-3.4	-3.1
20-99	-6.8	-7.3	+5.2	+4.0
<20	+6.8	+7.3	0	0

* Scenario 1: continuation of current policies
Scenario 2: policies implemented to speed move to bimodal size distribution
Scenario 3: policies implemented to slow trend to larger farm size.

Derived from OTA "Information on Size Distribution of Farms."

APPENDIX A

HISTORICAL PERSPECTIVES ON AGRICULTURE AND THE RURAL COMMUNITY

Settlement Patterns and Forms of Agrarian Organization in the Seventeenth and Eighteenth Centuries

The Northeast Region, although it encompasses only about 6 percent of the total U.S. land surface (Schertz, 1979:259), was settled over an extended, two-century-long period from roughly 1630-1830. The brief analysis that follows can hardly do justice to the changing conditions and nature of settlement over such a long period of time. Nevertheless, it is useful to consider the formative period of settlement and agrarian organization in the Northeast colonies, since the patterns that emerged at that early stage have had lasting impacts on farm and rural community structure up to the current era.

During the first century of settlement in the Northeast, there were two major forms of settlement patterns: the village settlement and the dispersed farmstead (isolated farmstead, or open country) patterns. The village settlement pattern involved the clustering of homes of farmers to form a village or hamlet, leaving the pastures, fields, and forest lands in the surrounding areas devoid of dwellings. Barns and other farm buildings were generally clustered toward the village core as well. The dispersed farmstead pattern, by contrast, involved farm dwellings and other buildings being located on the farming plot. Hence, farm residences would tend to be relatively isolated or scattered from one another. With regard to the village form of settlement, there was, in a sense, a clear unity of farm and community structure: The agricultural community consisted in large part of the farm families who had their residences and other buildings at the community core. The allotments of land made to settlers, in fact, tended not to be individually fenced, but rather the entire village community--both the village core and the outlying lands--was surrounded by a common fence. With regard to the dispersed farmstead system, settlers typically did not enjoy the presence of a hamlet or trade center; several years--often even a decade or more--would pass before there would appear a population concentration such as a hamlet (MacLeisch and Young, 1942:11).

Both the village and dispersed farmstead forms of settlement during the first century of colonization involved manorial (or estate) and nonmanorial subtypes. One of the major mechanisms of distributing land in the colonies was for the King of England to make large grants of land to his friends or supporters. Proprietors of these land grants were expected to colonize the land. The King, for example, made land grants to Lord Baltimore to found the colony of Maryland and to William Penn to found the colony of Pennsylvania. Many such proprietors receiving land grants attempted to create manorial estates with a system of hereditary nobles and peasants. These attempts were most common in Maryland and the Carolinas. Most attempts to establish manorial forms of agricultural organization involved transplanting the English village system to the colonies. There were, however, Dutch-colonial analogues of the manorial system that emerged in areas, such as the Hudson and Mohawk Valleys of New York State, where there was extensive land speculation and a general absence of the village settlement pattern (Ebling, 1979:25). Here the Rensselaers, Livingstons, Schuylers, and other families became aristocratic landlords who lived off the labors of their many tenants (Gates, 1960:36). The manorial-patroon system established by the Dutch in New York State was largely adopted by the British after Holland conceded the colony to England in 1664. This system would remain largely intact until the Revolutionary War, and remnants would persist until the mid-nineteenth century (Herman, 1979:38-49).

Attempts to establish manorial or semi-servile forms of agricultural organization, based either on village or dispersed farmstead settlement patterns, tended to be short-lived. To be sure, landlordism and tenancy were still flourishing in parts of New York State and Pennsylvania well into the late 1840s. Yet the general abundance of land tended to undermine manorial schemes. Would-be feudal lords in Maryland and elsewhere for obvious reasons found themselves unable to attract settlers, and many were forced to distribute their lands as gifts or sell land for nominal prices in order to encourage settlement.

In New England, virtually all the early settlements took the village form. These village settlements were very similar to English villages. Village settlements spread throughout most of Southern New England and, to some degree, into New York, New Jersey, and Pennsylvania. Until 1725, when the village system was experiencing a demise, land speculation was essentially unknown, and there tended to be a relatively small degree of social class inequality among farmers (Main, 1965). As the village system evolved, however, population growth in conjunction with destructive farming techniques tended to result in increasing landlessness, land fragmentation, and conflicts within the corporate group over taxation, property qualifications for voting, and the responsibility of the wealthy toward the poor. Outlying sections of the village typically sought to separate from the village, while the village centers resisted these demands (Lockridge, 1970:Chapter 3). Increasingly after 1750 the propertyless, poor, and the young and strong from Southern New England village groups began to look north and west for land to settle. Socioeconomic conditions in Southern New England—particularly Massachusetts—deteriorated even further after the Revolutionary War. State and local debts were high, leading to heavy and inequitable taxation. Land was becoming crowded, expensive, and worn out. The Massachusetts ruling class and the Congregational Church were felt to be unfair to the poor. Migration from Southern New England toward Northern New England and the western areas accelerated after the War.

New settlements after the early 1700s were largely of the dispersed farmstead type. The settlement of Northern New England, which began around 1765 and accelerated after the Revolutionary War, was virtually all of the dispersed farmstead type. In New York, where the original settlers were Dutch, the Dutch authorities placed considerable pressure on settlers to adopt the village form (Herman, 1979:38). These efforts were successful only to a minor degree, and the bulk of the state was settled with dispersed farmsteads. The dispersed farmstead settlement pattern that was to prevail in New York has generally been credited with diffusing the scattered-farmsteads form of settlement westward (Smith, 1970:123; Gates, 1960:Chapter 2). The colony of Pennsylvania had both village and dispersed farmstead settlement patterns from the beginning; most of the colony, however, was settled in the dispersed-farmsteads pattern, especially after the Revolutionary War.

There were a number of reasons why the village pattern of settlement, which was nearly universal at the outset of colonization, would ultimately yield to the isolated farmstead and complementary trade center pattern. First, the dispersed homestead form was most compatible with livestock production. Second, as responsibility for the dispersal of land shifted from a governmental to a proprietorial basis, there was less control over settlers' location of housing and other buildings, especially since settlers attempted to choose plots that had the highest quality land. Third, squatting became relatively prevalent on lands in Northern New England and the West, and the only means by which a squatter could hope to hold the land which he occupied extralegally was to establish himself and family directly on the farm. Fourth, the rapidly deteriorating socioeconomic conditions of the village settlements in Southern New England no doubt motivated settlers to avoid the organizational conditions that might lead to tyranny and inequality in their new regions of residence. Nevertheless, by 1800 the isolated farmstead and complementary trade center had become the predominant pattern of agricultural and rural community organization in the North.

The agricultural structures of the Northern colonies (and, after the Revolutionary War, the "Northern" states) generally involved relatively egalitarian landholding systems. At the time of the Revolutionary War, most farming communities were largely self-sufficient; relatively little wealth was accumulated, and accordingly there were few farmers of great wealth (Main, 1965). Relative equality of landholdings was generally the case in the frontier areas, especially outside of the parts of New York and western Pennsylvania where land speculation was prevalent.

There were two major exceptions to the pattern of relative equality of landholdings. The first exception was that of communities, generally in Southern New England or New Jersey proximite to cities or navigable rivers, where agriculture had become commercialized by the time of the Revolutionary War (Main, 1965:Chapter 1; Lockridge, 1970:Chapter 8). These farming areas, which produced foodstuffs for the growing urban populations, exhibited high degrees of concentration of land and income. It was typical, for example, in commercial farming areas of Massachusetts in the mid-eighteenth century for 50 percent of the income to be accounted for by the most affluent 10 percent of the population (Lockridge, 1970:142). Main (1965:28ff.) in his study of the class structure of America at the time of the Revolutionary War found that commercial farm communities tended, by comparison with subsistence communities, to have greater land concentration, relatively few small farmers, a larger proportion of propertyless laborers, and a larger proportion of artisans and professional men.

The second exception to the pattern of relative equality of landholdings in the Northern States was, as noted earlier, certain regions of New York, Pennsylvania, and New Jersey where land was originally controlled by "landed aristocrats" (Main, 1965:17), as in the Hudson and Mohawk Valleys of New York and portions of New Jersey, or where there was extensive land speculation, as in Western Pennsylvania and parts of Central and Western New York (Gates, 1960:Chapter 2). In the last decade of the eighteenth century, for example, one man in Penn Yan, New York, owned 25,000 acres that were rented to tenants (Gates, 1960:31), and eighteen individuals and partnerships held 4.2 million acres in Western Pennsylvania in the early 1930s (Gates, 1960:41).

Despite these staggering instances of land concentration in the Western frontier, there were strong tendencies as the nineteenth century unfolded for large landholdings and landlordism to disappear. In New York, Tory landholdings were confiscated after the Revolutionary War and sold to speculators and smallholders (Herman, 1979:47). Freeholding was given an additional post-Revolutionary-War boost when the state of New York granted large areas in central New York as homesteads to soldiers who served in the militia (Hedrick, 1933:63; Herman, 1979). Further, if tenant-settlers had no hope of obtaining ownership of their lands, they would be able to sell out or abandon their possessions and move west to new frontier areas. Landlords thus came to have to deal leniently with their tenants, lest they risk the wholesale abandonment of their properties by disgruntled tenants.

Large landholdings also tended to be liquidated over time as a result of tax burdens, slow returns from marginal lands, and the availability of nonfarm investment outlets. Other estates were divided upon inheritance or through foreclosure (Gates, 1960:Chapter 2). Monopolistic landlordism in New York was dealt its final blow by the Anti-Rent Movement in the 1830s through the 1850s, which carried out violent resistance against landlord-patroons during the early years and which would later elect Anti-Rent candidates to local and state offices (Herman, 1979:48, Hedrick, 1933:57-61).

Farm Structure and Rural Communities in the Nineteenth Century

Although many frontier areas tended to exhibit self-sufficient, subsistence agriculture, by the end of the second decade of the nineteenth century agriculture in the Northeast had become strongly commercial (Gates, 1960:Chapter 19). Commercialization was stimulated at the farm level by indebtedness and taxation and at the macro level by urbanization, industrialization, and transportation infrastructural development—especially steamboat- and canal-based commerce in the 1820s and 1830s and extensive railroad development from 1830-1860 (Cochrane, 1979:Chapter 11). Commercialization, however, was a mixed blessing for many farmers in the Northeast. On one hand, urban-market-led commercialization enabled many farmers to service their debts and avoid foreclosure, but Northeast agriculture generally fared poorly in the competition with Western farmers that was opened up by post-1830 transportation improvements.

The history of Northeastern agriculture during the nineteenth century was one of slow decline and relatively rapid adjustment. Numbers of farms and farmers in Southern New England began to level off and decline after the turn of the century. Farm numbers in Northern New England reached their apogee from 1840 to 1880, and farm numbers in the Middle Atlantic states were at their peak during the 1880s (Fitchen, 1981:Chapter 3; Edwards, 1940; Shannon, 1945:Chapter 11). Farm numbers in the region as a whole began a steady decline after 1880 (Tostlebe, 1957:50).

Agricultural decline in the Northeast was caused by several factors. First, and most important, was the deepening of commercial agriculture on an interregional basis, which subjected Northeastern farmers to the competition of their counterparts in Ohio, Indiana, and, later, the western prairie states (Edwards, 1940:204-5). At the same time, Northeastern farmers' competitive position was weakened by their general tendency to use primitive technologies--what Edwards (1940:205) referred to as being essentially "medieval" practices--which, in conjunction with land resources that were generally inferior to those of the West, galvanized agricultural decline in the Northeast.

It should be stressed, however, that the agricultural decline of the Northeast was highly uneven and that significant adjustments were made that, by and large, persist up to the present time. As late as 1840, Pennsylvania was America's leading wheat-producing state (Ebling, 1979:78), and Pennsylvania, New York, and New Jersey at that time were the nation's "bread states" (Edwards, 1940:205). There were several other prosperous areas of commercial agriculture in the Northeast at mid-century--especially the Connecticut Valley, the Narragansett country of Rhode Island, and the western counties of Massachusetts. But, in general, Northeastern agriculture from 1840 to the turn of the century underwent a progressive decline because of unfavorable agroecological conditions and western competition. By 1850, there were 7,000 miles of railroad in the country, and flour made from Western wheat was generally used by New England residents, even by farmers (Edwards, 1940:207). From 1840 to 1850, sheep raising in Southern

New England declined by nearly 50 percent and by an additional 35 percent from 1850-1860 (Edwards, 1940:207; see also Gates, 1960:Chapter 19; Shannon, 1945:Chapter 11).

Beginning after 1810, the Northeast region, especially Southern New England, began to experience three parallel trends--rapid population growth, urbanization, and industrialization--that would leave a lasting imprint on agriculture and community in the region. From 1810 to 1840, the population of the New England and Middle Atlantic states doubled, with much of this population increase concentrated in urban areas and derived from immigration. "[T]he population of the Eastern States increased from 3,487,000 in [1810] to 6,761,000 in 1840; urban centers of over 8,000 inhabitants increased from 3 in 1790 to 33 in 1840; while in southern New England all but 50 of the 479 townships had at least one manufacturing village clustering around a textile mill, an iron furnace, or some other industry" (Edwards, 1940:206).

These changes in the population morphology of the Northeastern states, in conjunction with Western competition, would have three major impacts on agriculture in the region. First, there developed a substantial home market, which deepened the commercialization of Northeastern agriculture. Second, Northeastern agriculture shifted from general farming to commodity specialization; each subregion after 1810 until 1840 came to concentrate on a small number of commodities for which the agroecological conditions were best suited. These commodities, because of their perishability or bulk, tended to escape Western competition. Third, commercialization and specialization stimulated technological change such as use of the grain cradle, the steel plow, and horse-drawn machinery (Edwards, 1940; Shannon, 1945:Chapter 11).

The Northeast Region thus became progressively more specialized in producing milk, butter, cheese, poultry, vegetables, and fruits for the growing urban markets. Market gardening and dairying developed in the close proximity of major urban areas, especially, New York, Philadelphia, Boston, Providence, and Newport. Production of fluid milk became more prevalent close to cities, while butter and cheese production increased rapidly in upstate New York, especially after completion of the Erie Canal. Other areas more distant from urban centers became specialized in cattle and sheep production while other areas emphasized producing horses or hay for city and town stables.

The restructuring of Northeastern agriculture to the conditions of western competition and creation of an urban home market was, nonetheless, an uneven process. The tendency toward specialization was earliest and strongest close to major urban centers. Credit was typically scarce, and many farmers found it difficult to secure the financing to alter their farm infrastructure in line with the new market imperatives (Gates, 1960: Chapter 19). Also, as Edwards (1940:207) noted, the impulse toward land speculation tended to cause many farmers with sufficient capital to restructure their enterprises to divert this capital into the purchase of more real estate rather than in new labor-saving machinery. Nonetheless, there was a steady trend across the region toward specialization of commodity production—a process that was substantially completed by 1850 (Cochrane, 1979:Chapter 4).

Equally significant for Northeastern agriculture and Northeastern society as a whole was the emergent articulation between farm and community structure based on backward and forward linkages between agriculture and industry. Virtually all manufacturing industry in the U.S. at mid-century was located in the Northeast. This industry was not, however, concentrated solely in large urban centers. Textile mills, grist mills, and other factories were quite dispersed spatially, as indicated in a previous quote from Edwards (1940). Edwards (1940:207) discussed the relationships between agriculture and community in the Northeast as follows:

> Now that the farmer received a cash income he turned to factories to supply him with the clothes, tools, and furniture he had formerly made for himself. The decline of household industries had as revolutionary an influence on rural life as the growth of industrialization had on the formation of a wage-earning class. As self-sufficient farming waned, long-established habits and traditions in thinking and living were uprooted. The family as an economic unit became less important, with all that implied for rural mores; farmers' sons and daughters began migrating to the mill towns to take up a new way of life. Those who remained behind developed a taste for urban standards of living.

Thus the articulation between agriculture and nonfarm industry, much of it located in relatively rural places, played a major role not only in the restructuring of the Northeastern agriculture, but also in contributing to the industrialization of the region during the nineteenth century (Gates, 1960:Chapter 2).

This articulation between agriculture and industry in the Northeast was, however, on less favorable terms for the former than for the latter. Northeast industry generally prospered during the latter decades of the nineteenth century, while Northeastern agriculture, relative to the other agricultural regions of the U.S., tended to stagnate. The average number of acres per farm in the Northeast region declined from 104 in 1870 to 95 in 1890; it would not be until 1950 that the average number of acres per farm in the Northeast would reach its 1870 level (Tostlebe, 1957:87)! Similarly, the average level of physical farm assets per farm increased by only 7 percent (in constant prices) from 1870-1900, by comparison with a 104 percent increase for the U.S. as a whole. The Northeast region was the only U.S. region that exhibited a decline in the value of physical farm assets per farm from 1900-1920. For the entirety of the 1870-1920 period, the Northeast exhibited the slowest rate of increase in physical farm assets on the basis of both aggregate and per farm comparisons (Tostlebe, 1957:Chapter 4). Gross farm income in the region increased by only about 30 percent from 1869 to 1899 (in constant prices), while the next-most-stagnant agricultural region--the Appalachian region--exhibited an increase of more than 100 percent during the same time period (Tostlebe, 1957:215). From 1890 to 1900, the Northeast region began to experience an absolute decline in the number of persons engaged in agriculture (Tostlebe, 1957:48), while all other U.S. regions during the decade exhibited increases in the number of persons in agriculture. This decline in the number of persons in agriculture in the Northeast region would continue more or less unabated until the 1970s.

Two further aspects of agricultural change in the Northeast should be noted. First, by the end of the nineteenth century virtually all estate-type holdings--save the Wadsworth holdings in Genesee County, New York--had disappeared (Hedrick, 1933:62-3). By 1880, the Northeast in general and New York in particular had tenancy rates well below the U.S. average (Shannon, 1945:418). Second, beginning during the 1880s there began a trend toward the decline of land in farms that, with the exception of the Depression years, was not stemmed until 1945. From 1880 to 1940, land in farms in the Northeast declined from 68.0 to 47.0 million acres, and improved land from 46.4 to 26.6 million acres (Tostlebe, 1957:50). The bulk of this land reverted to forests.

Concomitant with the agricultural decline of the Northeast at the end of the nineteenth century were the beginnings of rural community dislocations. For example, Fitchen (1981:Chapter 3) in her study of an upstate

New York farm community noted that the period from 1870-1920 was one of slow decline of agriculture and shifts in the relationships between farm families and the trade center/hamlet. Most farms were small and combined subsistence and commercial farming. There was a steady turnover of the farm population as farmers left agriculture for jobs in towns, farm children left the farm for education or employment, and new farm operators came in to buy up the hill farms when others left. The farm population, nevertheless, slowly but steadily declined, and the most marginal farmland was abandoned for forest. Farming remained the predominant economic base of the community, but this base was unhealthy. Fitchen noted in her historical research that the increased rate of turnover in the ownership and operation of farms tended to reduce the cohesion of the hamlet community, while the diminishing farm population caused a contraction in the volume and diversity of retail trade. Further, the region as a whole was experiencing growth in large villages and cities, and Fitchen found that farm families and residents of the trade center community began to turn to larger outlying villages and cities for more and more of their retail purchases. Fitchen argues, nonetheless, that the hamlet, though experiencing decline from 1870-1920, remained a viable, active community. But this community ultimately was to experience disintegration in the period from 1920-1950 as the two forces that emerged earlier--agricultural decline and the rising importance of larger villages and cities--became intensified after World War I. This trend would become quite widespread in the areas of the Northeast that had low-quality agricultural resources and were a long distance from major urban centers.

Structural Change in Northeast Agriculture, 1900-1970

Farm population and number of farms. Tables A-1 and A-2 report data on the size of the farm population and the number of farms, respectively, in the U.S. and the Northeast from 1900-1969. The data in Table 1 on trends in the size of the farm population indicate the distinctiveness of the Northeast region in that the region's farm population began to decline significantly after 1900 and, with the exception of the decade of the Great Depression, declined steadily until 1969. The Northeast's farm population decreased from 3.364 million in 1900 to 0.741 million in 1969, a 78 percent decline, while the U.S. farm population declined by about 58 percent during this same period. Moreover, the U.S. farm population did not begin to decline appreciably until the early 1940s. Table A-1 also indicates that the farm population in the six New England states declined at a more rapid rate than did that of the three Middle Atlantic states. In 1969, roughly 81 percent of the Northeast Region's farm population was in the three Middle Atlantic states.

Data on the number of farms in the Northeast Region and the U.S. from 1900-1969 are given in Table A-2. These data closely parallel those for size of the farm population. Farm numbers in the region began a long-term pattern of decline after 1900, interrupted only by World War II. Farm numbers in the U.S. as a whole did not begin to decline until after 1920, and the rate of decline was quite slow until the post-World War II period. Within the Northeast Region, the rate of decrease in farm numbers was consistently more rapid in the New England states than in the Middle Atlantic states (see Stanton and Plimpton, 1979). The post-war loss of farms in both the U.S. and the Northeast was most pronounced among relatively small farms (Schertz, 1979; Stanton, 1984; Stanton and Plimpton, 1979).

Land in farms. Schertz (1979:259) has argued that "[o]ne of the most striking developments in farming in the Northeast has been the decrease in land used for crops for 100 years." He goes on to note that total acres of cropland in the region peaked around 1880 and declined thereafter. After rising again during the Depression and World War II years to a level of 21 million acres in 1944, the region's cropland acres reached a post-World War II low of 12 million acres in 1969. The rate of decline in cropland acres in the Northeast after World War II was far sharper than in the U.S. as a whole. Moreover, according to Schertz, while the Northeast followed the general national trend in the 1960s toward increases in cropland acres, the increase in cropland in the Northeast began later--in 1969, as opposed to 1962 for the U.S. as a whole--and was relatively smaller--8 percent in the Northeast compared to 13 percent for the U.S. (Schertz, 1979:259-60).

Table A-3 reports data for the Northeast and the U.S. on trends in total land in farms. It should be kept in mind that acres of land in farms and acres of cropland are, of course, closely related but are not identical; not all land in farms is utilized as cropland. In the 1970s in the Northeast, about 60 percent of land in farms was used as cropland, as opposed to about 35 percent for the U.S. as a whole. The majority of noncropland in Northeast farms is in forests, while nationally nearly two-thirds of noncropland in U.S. farms is devoted to pasture. Nevertheless, the data in Table A-3 underscore the rapid decline in land devoted to agriculture in the Northeast since the turn of the century. Land in farms in the Northeast declined steadily after 1900, with the exception of the Great Depression and World War II interlude during which farm numbers and land in farms registered temporary increases throughout the U.S. By 1969, less than 3 percent of the land in farms in the U.S. was in the Northeast region. About 80 percent of the land in Northeast farms lies in the three Middle Atlantic states.

Average acreage per farm. The Northeast has long had relatively small farm operations by comparison with the U.S. as a whole, as indicated in Table A-4. Average acreage per farm in the Northeast was virtually constant from the late 1800s to the end of World War II, averaging roughly 100 acres per farm during the 65 years from 1880 to 1945. By comparison, average acreage per farm in the U.S. after 1880 rose steadily, with the exception of a slight decline in average acreage during the first half-decade of the Great Depression.

Following the end of World War II, average acreage per farm in the Northeast began to increase, from 98 acres per farm in 1945 to 169 acres in 1969, a 72 percent increase. This rate of increase, however, was smaller than for the U.S. as a whole (from 195 acres per farm in 1945 to 390 acres in 1969, a 100 percent increase). Average acreage in farms in the New England subregion increased more rapidly than in the Middle Atlantic subregion during the post-World War II period. In 1969, New England farms averaged 195 acres, while Middle Atlantic farms averaged 163 acres.

Average value of farm property per farm. Table A-5 reports data on the average value of farm property per farm from 1850 to 1969 for the Northeast Region and the U.S. These data indicate that average value of farm property per farm in the Northeast was substantially above the national average until the turn of the century. After 1900, however, the value of farm property per farm in the Northeast was generally lower than that of the U.S. as whole, with the exception of the Great Depression decade. Moreover, these disparities have generally increased so that by 1969, Northeast farms averaged $59,426 in farm property while U.S. farms averaged

$75,725. Average value of farm property per farm in the six New England states was virtually identical to that of the three Middle Atlantic states in both 1945 and 1969.

Value of farm products sold. Data on the total value of farm products sold for the Northeast Region and the U.S. from 1930 to 1969 are given in Table A-6. These data show that at the onset of the Great Depression, farmers in the nine Northeastern states accounted for roughly 10 percent of the value of total U.S. farm products sold (978 and 9,610 million, respectively). With the exception of the Great Depression decade, the Northeast Region has experienced a slow decline in its relative share of farm products sold. By 1969, the value of farm products sold by farmers in the Northeast Region was about $2.8 billion, which represented slightly over 6 percent of the $45.6 billion of farm products sold by U.S. farmers in that year. Within the Northeast Region, the Middle Atlantic states, especially New York and Pennsylvania, have been far more dynamic in terms of aggregate gross farm sales than have the New England states. The Middle Atlantic states accounted for 76 percent of the region's sales of farm products in 1969 and exhibited a 100.1 percent increase in farm products sold from 1945-1969 as opposed to the 89.3 percent increase for the New England subregion. In addition, the total value of farm products sold in New England declined from 1964 to 1969, making New England the only one of the nine U.S. Census of Agriculture subregions to exhibit a decrease in sales of farm products during this period.

Farm structural change in the Northeast, 1900-1970: A summary. Farm structural change in the Northeast generally paralleled national trends during the first seven decades of the twentieth century, but did so on a less dynamic basis than the rest of the U.S. agricultural regions. The declining relative position of the Northeast in the U.S. farm structure reflected continuity with trends, discussed earlier, that began before 1850. The Northeast, with its generally low-quality soils, short growing seasons, and rough topography, had 60 percent less land in farms in 1969 than it did 100 years earlier. These agroecological conditions have contributed to the slow pace of centralization of farm land into larger units. Farms in the region generally were relatively small by national standards, and there was very little industrial-type farming in the region at the end of the 1960s. Thus, in the 25 years after World War II, the Northeast Region experienced declines in the number of farmers and the size of the farm population that were far more rapid than for the U.S. as a whole, but the pace of concentration of land and farm assets during the same period was far slower than the national average. As farmers and members of their families left agriculture, so did much of their land, most of which reverted to forests and brush (Stanton and Plimpton, 1979:11-14, 23).

Rural Communities and the Rural Population in the Northeast, 1900-1970

The character of our current knowledge on rural communities has changed dramatically since the 1920s through the 1950s when detailed community case studies--many of them done on a national basis--were quite common. As Larson (1981:147) has noted, "comprehensive information about rural communities and recent social change in American rural society does not equal that available in the 1920s, 1930s, and 1940s, aside from demographic and similar census-type data, [since] systematic nationwide studies that would provide this information have been discontinued." While the data on rural communities over the past two decades have been derived largely from census statistics, the data that are the basis of this section of the report were largely generated from "social surveys" of communities.

The advantages of census-type data are their regular availability and suitability for statistical analyses using areal units (e.g., counties) as the units of analysis. The key advantage of the older method of community analysis was its richness of detail about the nature of social relationships and subcommunity processes. The very richness of these data, however, does not lend them to a brief summary for purposes such as those of this report. Fortunately, however, we will be able to make use of several useful summaries by Taylor et al. (1949), Kolb and Brunner (1952), Brunner and Kolb (1933), Richardson and Larson (1976), and others.

From the outset of the twentieth century, the Northeast has been the most highly urbanized region in the nation. As early as 1920, the Northeast region's population was in excess of 75 percent urban, while the U.S. population as a whole was only 51.4 percent urban in that same year (Brunner and Kolb, 1933:16). In this same year about two-thirds of the Northeast's rural population was nonfarm, while for the U.S. as a whole, fewer than four out of ten rural residents were nonfarm (Brunner and Kolb, 1933:17).

The most comprehensive data on rural communities in the Northeast during the early twentieth century can be found in Brunner and Kolb's (1933) compilation of impressively detailed information on 140 rural villages across the U.S. for 1920 and 1930. Brunner and Kolb's comparative regional analyses of rural social trends generally underscored the influences of urbanization and industrialization on one hand, and agricultural stagnation on one other, in shaping the character of rural communities in the Northeast. They (1933:88) noted, for example, the fact that in the Northeast a large proportion of rural village and open country residents was employed in nonagricultural pursuits and that "[in] some of the New England states, supplementary work has grown to such an extent that it has become the more important source of income for many farmers who might be better characterized as part-time farmers than as farmers doing part-time work" (Brunner and Kolb, 1933:50).

The data reported by Brunner and Kolb for villages in the Middle Atlantic states (the authors generally did not report data for the New England states) have a dual character. On one hand, incorporated--generally relatively large--places in the Middle Atlantic Region tended to show rates of population growth well in excess of the national average from 1910 to 1930. The trend toward vibrant growth was particularly strong for relatively large Middle Atlantic incorporated places; of the villages in the Northeast with 1,750 or more residents in 1910, 53.3 percent exhibited population growth in excess of 20 percent from 1910-1930, while 42.1 percent did so in the U.S. as a whole (Brunner and Kolb, 1933:75). However, Brunner and Kolb (1933:69) also reported data showing that agricultural neighborhoods in the Middle Atlantic region were disintegrating at a more rapid pace than in the entire U.S., and much of their data on the socioeconomic conditions of agricultural hamlets and small villages in the various regions of the U.S. suggested a pattern of agricultural community decline in the Northeast. Overall, the data indicated that the growing industrialization and spread of urban influence in the Northeast were tending to benefit relatively large, incorporated villages in urban areas of the region, while smaller hamlets and villages in peripheral areas of the region were tending to experience declines related to the lack of dynamism in the agricultural sector (see MacLeisch and Young, 1942, for a corroborating case study of a community in New Hampshire).

The Brunner and Kolb data generally showed that rural villages in the Middle Atlantic region had less advantageous socioeconomic conditions than villages in the Midwest and Far West, with only the Southern region having poorer socioeconomic conditions than the Middle Atlantic area. This observation was the case for per capita retail sales (p. 163), retail stores per village (p. 146), average expenditures for village schools (p. 178), tax revenues per capita (p. 294), and other village characteristics.

Brunner and Kolb's observations about the socioeconomic conditions of rural communities in the Middle Atlantic area were repeated two decades later by Kolb (1952). Kolb (1952:190-1) reported that from 1940 to 1950, nonsuburban villages (with populations of 1,000 - 2,500) in the Middle Atlantic area had, along with the West North Central region, the slowest rate of population growth in the U.S.

The foregoing observations about rural communities in the Northeast before mid-decade can be supplemented by the data collected by Carl C. Taylor and his associates (1949) in the Division of Farm Population and Rural Life of U.S.D.A.'s Bureau of Agricultural Economics. Taylor et al. identified seven major type-of-farming areas in the U.S. (the cotton belt, the corn belt, the wheat areas, the range-livestock areas, dairy areas, Western specialty-crop areas, and the general and self-sufficing areas) and argued that the commodity in which an area was specialized would shape the character of local community life and of town-country relationships. In terms of the seven type-of-farming regions identified by Taylor et al., their observations on the dairy and the general and self-sufficing areas are most germane for our purposes.

The dairy area identified by Taylor et al. (1949) encompassed the bulk of the counties in upstate New York; most of Vermont; portions of Southern New Hampshire, Massachusetts, Connecticut, and New Jersey; and several counties in the Eastern, Western, and Southeastern fringes of Pennsylvania. Arthur F. Raper (1949a), the author of the chapter on the dairy areas, argued that the nature of dairying--the types of inputs purchased and the need to market milk to a local creamery, cheese factory, or other processing plant--tended to make for a close relationship between farm families and their local hamlet or village trade center. Raper noted, however, that there was a different configuration of farm-trade center relations in New England than in the rest of the dairy areas. In New England, social and political activity has long tended to revolve around the town, rather than the county, and accordingly New England dairy farmers were more likely to identify with and trade within small town centers that were non-New England dairy farmers; west of New England, where counties were more important than townships, village trade centers tended to be larger than those in New England and tended to offer a more complete range of commercial services. Raper emphasized as well the fact that the nature of dairying--especially its year-around character and location in agroecological areas unsuited for large-scale grain or livestock farming--tended to lead to relatively small farm operations with little hired labor. Further, because dairy areas tended to have a high level of urbanization and industrialization, these areas had a relatively high prevalence of part-time farming. Raper also detected a trend toward recreational development in dairy areas, especially those in the Northeast. He noted (1949a:432) that recreational development was leading to an "influx of urban people, many of whom are wealthier and better educated than the resident farm families" and that this influx was "affecting local leadership, local organizations and institutions, market outlets for dairy and other farm products, and other aspects of farm and community life."

At the time that Raper wrote about rural communities in the dairy areas, the presence of a creamery or cheese factory in a local village was nearly universal, and he placed great stress on the marketing nexus in the cohesion of dairy communities. Since that time, of course, one of the major trends in the U.S. dairy industry as a whole has been the shift to Grade A/fluid milk production, with most milk sold to large plants in large villages and cities (Jacobson, 1980). Accordingly, in a more recent period, Richardson and Larson (1976) observed a strong trend among New York farming villages for there to be a decline in agriculturally-related industries (and a rise in nonagricultural industries). Thus, the character of dairy-based farm communities in the Northeast has changed substantially since Raper's (1949a) study--with the decline of the village creamery and cheese factory spearheading the increased orientation of farm families' input and retail purchases and marketing decisions away from smaller villages.

The "general and self-sufficing areas" in the Northeast Region, as defined by Raper (1949b), were primarily located in New York's Southern Tier; in Southern Maine and New Hampshire; in parts of Massachusetts, Connecticut, Rhode Island, and New Jersey; and in the central three-quarters of Pennsylvania. The principal defining characteristics of these areas were their low quality agricultural lands, small farm operations, lack of commodity specialization, low farm incomes, tendency toward part-time farming, and, in some areas, the persistence of small-scale, self-sufficient farming. Raper emphasized that the general and self-sufficing areas had an extraordinarily high degree of interaction between farm households and villages. Given the lack of commodity specialization, many farm products were marketed directly to residents of the village. Also, given the typical rough terrain, social interaction and retail purchases tended to be sharply delineated by village. The life of the village was typically organized around the school and the church. Raper noted that, similar to the dairy areas, farm-village relationships tended to vary between New England and the remainder of the general/self-sufficing areas; in New England, retail purchases and social interactions tended to be focused around the center of town (township) government, while larger county-seat villages and cities tended to be more important outside of New England.

To our knowledge, the only significant quantitative empirical study of the relationships between farm and rural community structure during this period in the Northeast has been that of Swanson (1982). Swanson's study was oriented toward investigating the "Goldschmidt thesis" (see Goldschmidt, 1978; Buttel, 1982a, 1983a) in Pennsylvania. More specifically, Swanson's concern was with whether rates of decline in farming numbers and of the increase in average farm size were associated with declines in farm trade center populations during the 1930-1960 period, which represented hypotheses consistent with the Goldschmidt thesis. Swanson examined 520 agricultural trade centers in 30 Pennsylvania counties over the 30-year period, and his results were generally inconsistent with the Goldschmidt thesis. In particular, there was no association between declining farm numbers and changes in the population of Pennsylvania agricultural trade centers, and there was a positive association between average farm size (measured as total acres harvested per farm) and trade center population over the 30-year period. It should be noted, however, as Swanson did, that average farm size in the 30 Pennsylvania counties increased very little (X = 16 acres) over the period, implying that there was little dramatic farm structural change of the sort that Goldschmidt (1978) referred to in his study. The small increases in average farm size in Swanson's Pennsylvania study area, moreover, were from a relatively small base in 1930 (40.5

harvested acres per farm), and family farmers were quite readily able to absorb increased harvested acreages into their farms with modest use of mechanization and with little or no hired labor. Overall, total harvested acres per rural community declined by 21 percent from 1930 to 1960, consistent with the pattern noted above for the Northeast Region as a whole.

Swanson's study suggests two other findings of importance to the relationships between agriculture and community in the Northeast. First, Swanson found that the principal predictor of population change in Pennsylvania agricultural trade centers was change in the proportion of the population employed in manufacturing and tertiary industries, with increases in the former associated with increases in the latter. Average distance to the nearest urban place and to the nearest metropolitan center were generally not associated with population change in farm trade centers, except for a negative relationship between distance to the nearest metropolitan center and trade center population change in the agriculturally-rich, highly-urbanized southeastern region of Pennsylvania. Second, there was evidence that regional economic changes had affected not only trade center population change, but also farm structure. Swanson argued that expansion of trade center populations tended to encroach upon villages' farm land bases, accelerating the rate of loss in land in farms. He also suggested that regional economic change in the form of expanded employment opportunities in manufacturing and services tended to stabilize farm numbers through the availability of the part-time farming option.

More recently, Ali (1973) studied the 13 villages in New York State which were among the 140 villages studied by Brunner and his colleagues (1927, 1933, 1937) in the 1920s and 1930s. Ali focused on changes over the

1920-1970 period, relying primarily on census and **Dun and Bradstreet Reference Book** data. Defining population growth as an increase of 1 percent or more per year, stability as an increase of less than 1 percent per year, and decline as any loss in population over the period, Ali found that five villages had grown, six were stable, and two had declined in population. The five villages with high rates of growth were all located within or adjacent to (1970) SMSA counties, while both declining communities were distant from SMSAs.

Ali (1973) also examined trends in the number of business services in the 13 communities as reported by Dun and Bradstreet. He found that there were very high correlations between population size and the number of business services (r = .70 or larger in 1924, 1930, and 1936, and .91 in 1970). In addition, the number of business services was closely associated with proximity to an SMSA county; of the eight communities in or adjacent to an SMSA, seven exhibited increases in the number of business services and one stayed the same over the 50-year period. However, for five villages distant from an SMSA, four experienced declines in the number of business services and one stayed the same.

In the early 1970s Richardson and Larson (1976) restudied the same villages examined by Ali and by Brunner and associates in the 1920s and 1930s. Richardson and Larson noted that while most of the 13 New York villages had been relatively stable over time, there was strong evidence of increased socioeconomic differentiation among these villages. Moreover, their stability was strongest in noneconomic terms--e.g., in the persistence of neighborhood and social functions--than it was in the economic sphere. Overall, Richardson and Larson detected a pattern of differentiation among the 13 communities based on the ability "to compensate for the major adjustments in the farming part of their communities" (Richardson and Larson, 1976:57). The communities that were able to do so were those located in or proximite to SMSAs in which "vanishing farmers are being replaced, or more than replaced, by nonfarmers" (p. 57). Villages located far from SMSAs had been generally unable to compensate for the decline in farm operators and the farm population. This latter pattern is consistent with Fitchen's (1981) analysis of a declining rural hamlet in a nonmetropolitan region of New York. Finally, Richardson and Larson (1976:57), relying on the data collected by Ali (1973), noted that "[i]ncreasingly, town (township) rate of population growth has been outstripping that of the population center." Richardson and Larson's observation about the relatively vibrant growth of the hinterlands of the 13 New York agricultural villages parallels the findings of Brown and Beale (1981:29-31) about regional patterns of population growth and decline of nonmetro counties in the 1960s and 1970s. Brown and Beale's data show that the nonmetro population "turnaround," which began in the U.S. in the beginning of the 1970s, began far earlier in the Northeast-Great Lakes Region. Over 75 percent of nonmetro counties in the Northeast-Great Lakes area exhibited population growth during the 1960s, compared to 47.5 percent of nonmetro counties in the U.S. Nearly 71 percent of Northeast-Great Lakes nonmetro counties grew in population during both the 1960s and 1970s. Only 44.3 percent of U.S. nonmetro counties experienced population growth during both decades. Eighteen percent of U.S. nonmetro counties exhibited population declines in both decades, compared to only 3.5 percent of Northeast-Great Lakes nonmetro counties.

The data reported by Brown and Beale underscore the high degree of influence of the urban-industrial economy in the Northeast, similar to the configuration revealed by Swanson (1982). Thus, the Northeast, which experienced disproportionately rapid declines in the farm-population and in the number of farm operators during the post-War period up to 1970, was the region of the country with the most favorable pattern of nonmetro population growth during the 1960s and 1970s. Clearly, the rapid decline in farm numbers in the Northeast in the 1960s did not, in the main, lead to deterioration of the nonmetro social fabric in the region because of its strongly urban-industrial character. It should be kept in mind, however, that despite the pervasiveness of urban-industrial forces in the Northeast region, there remain a significant number of nonmetro counties that lie outside the orbit of these forces (see Eberts, 1984). The two declining New York village communities studied by Richardson and Larson (1976), the New York hamlet studied by Fitchen (1981), and Shover's (1976) case study of Bedford, Pennsylvania, are examples of this latter pattern.

Further perspective can be gained on the character of the Northeast's nonmetro population at the end of the first seven decades of the twentieth century from the research of Hines et al. (1975). Hines et al. reported data on the socioeconomic characteristics of the population of metro and nonmetro counties for 1970 disaggregated by region. The following are among the observations made by Hines et al. about the characteristics of the Northeast nonmetro population relative to the North Central, South, and West regions.

The Northeast's nonmetro population in 1970 was distinctive in that it had the lowest proportion, 5.2 percent, of residents of the four major regions in extractive industries (agriculture, forestry, fisheries, and mining), while the U.S. nonmetro average was 11.1 percent. Likewise, the Northeast nonmetro counties had the highest proportion of employment in manufacturing (29.2 percent) and the second highest proportion in the service industries (28.4 percent), compared to the U.S. averages of 24.3 and 27.2 percent, respectively. But while the Northeast nonmetro population had a strongly "urban" labor force profile, Hines et al. (1975:36) reported that the Northeast Region as a whole was the only one to have exhibited a decline from 1960 to 1970 in the number of workers in manufacturing (-6.9 percent), while the nonmetro counties in the Northeast had the second lowest rate of increase (6.2 percent) in the number of manufacturing workers among the four major regions. The nonmetro population of the Northeast, however, showed substantial growth in employment in the service sector (32.8 percent) from 1960 to 1970, which was slightly above the average for the U.S. nonmetro counties as a whole (28.6 percent). Thus, while the Northeast's nonmetro counties did experience the growth in rural industrialization that became prevalent throughout the U.S. in the 1960s and 1970s (Campbell, 1975; Summers et al., 1976), the region's nonmetro counties were already highly industrial in 1960 and exhibited little increase in manufacturing employment during the decade. The Northeast's growing nonmetro population tended more strongly to take service sector jobs from 1960-1970.

Data reported by Hines et al. (1975:41) on median 1970 earnings for residents of nonmetropolitan counties showed that the Northeast was well above the U.S. nonmetro average ($6,970 and $6,236 for males, and $3,363 and $3,052 for females, respectively). Earnings of Northeast nonmetro males were the second highest of the four regions, while Northeast nonmetro females' earnings were the highest in the country. These high nonfarm wage rates encouraged farmers in the Region to leave agriculture in the post-World War II period (Schertz, 1979:274). But while earnings of Northeast nonmetro residents were above the national average in 1970, the nonmetro Northeast's median family income grew somewhat more slowly (68.3 percent) from 1959-1969 than it did in U.S. nonmetro counties as a whole (69.4 percent; Hines et al., 1975:46).

The pattern that emerged from the Hines et al. data was of a Northeast nonmetro population that was relatively privileged in 1970, but that was tending to decline in its socioeconomic advantages relative to the U.S. nonmetro population as a whole. The relatively slow pace of nonmetro industrial growth in the region, which paralleled the decline of Northeast industry that began in the 1960s (Young, 1984), apparently contributed substantially to this phenomenon. The Northeast nonmetro counties also experienced a decline in employment in the extractive industries (-36.0 percent) during the 1960-1970 decade that was above the national nonmetro average (-34.0 percent) (Hines et al., 1975:36). The decline of the Northeast's extractive industries' employment probably contributed to some degree to the worsening of the Region's relative socioeconomic status among the nation's nonmetro counties, especially in the Region's highly rural areas such as Northern New England and the North Country of New York State.

Table A-1. Farm Population, 1890-1969, By Division, Region, and State.

Division, region, and State	Farm population (1,000)													
	1969	1964	1959	1954	1950	1945	1940	1935	1930	1925	1920	1910	1900	1890
United States	10,307	12,954	16,592	19,019	23,048	24,420	30,547	32,161	30,529	31,190	31,974	32,077	29,875	24,771
Northeast	741	929	1,178	1,297	1,791	1,908	2,411	2,633	2,287	2,435	2,537	2,901	3,364	3,194
New England	138	183	246	301	403	448	623	718	575	617	633	764	892	878
Maine	33	46	66	88	122	125	176	187	171	190	200	247	267	283
New Hampshire	12	17	23	32	47	61	71	77	63	72	77	102	131	130
Vermont	34	45	60	66	81	76	107	123	113	122	127	142	152	148
Massachusetts	30	39	52	61	80	111	147	165	124	125	120	140	183	167
Rhode Island	4	5	6	8	10	12	17	22	17	16	15	20	28	28
Connecticut	25	30	39	47	63	71	105	144	87	92	94	112	131	123
Middle Atlantic	603	747	929	1,095	1,388	1,460	1,788	1,916	1,712	1,818	1,904	2,137	2,472	2,317
New York	254	321	408	467	578	601	730	789	722	768	806	922	1,113	1,076
New Jersey	50	61	75	85	105	112	143	145	131	138	145	165	176	155
Pennsylvania	300	365	446	543	705	746	915	981	859	912	953	1,050	1,183	1,085
North Central	4,496	5,246	6,191	6,732	7,433	7,767	9,349	9,951	9,583	9,805	10,158	10,714	11,094	9,995
East North Central	2,147	2,519	2,974	3,276	3,703	3,866	4,638	4,808	4,501	4,637	4,953	5,275	5,653	5,144
Ohio	434	515	607	717	853	893	1,089	1,136	1,016	1,060	1,149	1,245	1,364	1,241
Indiana	432	493	569	606	667	696	816	860	815	848	914	997	1,071	995
Illinois	492	565	662	694	763	808	879	1,026	1,002	1,033	1,107	1,219	1,341	1,289
Michigan	324	410	510	590	695	704	871	847	785	807	856	912	982	843
Wisconsin	464	537	636	668	725	765	983	939	883	889	927	902	904	773
West North Central	2,349	2,727	3,217	3,457	3,729	3,901	4,711	5,143	5,082	5,168	5,205	5,440	5,441	4,851
Minnesota	502	572	671	698	740	753	918	934	898	905	903	833	856	641
Iowa	565	645	755	767	783	818	931	974	981	990	991	1,053	1,139	1,047
Missouri	417	515	630	747	863	882	1,126	1,192	1,118	1,172	1,219	1,352	1,475	1,318
North Dakota	161	187	220	235	254	277	328	389	398	397	398	369	239	139
South Dakota	178	201	228	238	264	261	307	360	391	380	364	371	274	240
Nebraska	263	301	349	370	391	417	498	585	587	588	588	631	619	616
Kansas	263	306	364	401	444	495	607	709	709	733	742	830	838	851
South	4,058	5,513	7,613	9,139	11,896	12,740	16,400	17,162	16,364	16,762	17,063	16,657	14,226	10,723
South Atlantic	1,483	2,106	2,984	3,573	4,633	4,891	6,060	6,283	5,914	6,215	6,496	6,212	5,271	4,209
Delaware	16	21	26	29	34	39	46	50	47	49	52	58	50	47
Maryland	84	108	135	150	183	201	246	245	238	261	283	297	254	221
District of Columbia	...	...	...	...	...	...	...	...	...	...	...	1	1	2
Virginia	259	366	502	579	732	831	986	1,066	853	1,020	1,078	1,065	952	748
West Virginia	84	117	165	264	411	445	533	569	450	466	484	614	535	429
North Carolina	507	710	1,006	1,126	1,377	1,360	1,659	1,645	1,604	1,566	1,520	1,406	1,258	998
South Carolina	165	282	455	543	701	709	917	960	919	1,001	1,088	870	835	628
Georgia	261	371	530	697	962	1,062	1,368	1,424	1,423	1,566	1,706	1,694	1,163	950
Florida	117	140	165	180	233	254	305	324	280	286	285	273	203	185
East South Central	1,433	1,933	2,641	3,146	4,048	4,271	5,283	5,409	5,109	5,163	5,257	5,291	4,860	3,833
Kentucky	474	550	652	768	974	1,038	1,261	1,326	1,180	1,249	1,324	1,286	1,267	1,024
Tennessee	412	538	715	818	1,016	1,046	1,276	1,326	1,219	1,249	1,290	1,278	1,246	1,007
Alabama	240	367	553	708	960	1,068	1,343	1,405	1,344	1,343	1,355	1,383	1,166	909
Mississippi	308	477	721	852	1,097	1,119	1,403	1,352	1,366	1,322	1,288	1,344	1,181	892
West South Central	1,141	1,474	1,988	2,420	3,215	3,578	5,057	5,470	5,341	5,384	5,310	5,154	4,095	2,681
Arkansas	245	327	483	595	802	798	1,113	1,198	1,122	1,153	1,165	1,107	956	804
Louisiana	173	240	328	414	567	608	854	872	833	823	798	732	608	431
Oklahoma	219	258	318	404	553	651	930	1,031	1,027	1,045	1,033	1,022	587	44
Texas	503	650	860	1,007	1,292	1,520	2,160	2,369	2,359	2,363	2,314	2,293	1,943	1,401
West	1,011	1,265	1,613	1,751	1,929	2,008	2,387	2,415	2,295	2,188	2,216	1,805	1,192	859
Mountain	471	577	719	780	859	905	1,118	1,199	1,143	1,119	1,179	918	502	312
Montana	94	106	123	128	136	134	176	197	205	209	228	111	67	32
Idaho	107	128	158	159	165	161	203	201	189	189	203	148	81	39
Wyoming	35	41	52	54	57	53	73	76	74	69	68	62	30	18
Colorado	99	122	154	175	198	191	253	278	284	267	268	203	115	97
New Mexico	48	60	76	103	132	149	178	192	159	164	163	181	61	43
Arizona	37	55	73	74	77	101	114	101	99	92	92	85	33	11
Utah	41	53	69	74	81	102	105	139	116	124	141	122	106	66
Nevada	10	11	13	13	13	14	16	15	17	15	16	13	9	7
Pacific	541	689	894	971	1,070	1,102	1,270	1,216	1,152	1,069	1,037	887	690	546
Washington	140	170	216	242	274	304	349	342	306	291	289	260	171	123
Oregon	124	145	176	200	228	233	259	253	224	217	219	210	180	141
California	268	362	502	529	568	565	670	621	622	561	529	417	339	283
Alaska	2	2	...	...	...	...	...	...	...	...	...	...	...	...
Hawaii	7	9	...	...	...	...	...	...	...	...	...	...	...	...

SOURCE: Tables 1-6 are taken from U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, Bicentennial Part 2 (Washington, D.C.: U.S. Government

Table A-2. Farm Numbers in the U.S., 1850-1969, By Division, Region, and State.

Division, region, and State	Number of farms (1,000)																	
	1969	1964	1959	1954	1950	1945	1940	1935	1930	1925	1920	1910	1900	1890	1880	1870	1860	1850
United States	2,730	3,158	3,711	4,782	5,388	5,859	6,102	6,812	6,295	6,372	6,454	6,366	5,740	4,565	4,009	2,660	2,044	1,449
Northeast	152	202	255	339	400	498	483	556	483	578	582	657	678	659	696	602	566	490
New England	29	42	57	82	103	150	135	158	125	159	157	189	192	190	207	181	184	168
Maine	8	13	17	23	30	42	39	42	39	50	48	60	59	62	64	60	56	47
New Hampshire	3	5	7	10	13	19	17	18	15	21	21	27	29	29	32	30	31	29
Vermont	7	9	12	16	19	26	24	27	25	28	29	33	33	33	36	34	32	30
Massachusetts	6	8	11	17	22	37	32	35	26	33	32	37	38	34	38	27	36	34
Rhode Island	1	1	1	2	3	4	3	4	3	4	4	5	5	6	6	5	5	5
Connecticut	4	6	8	13	16	22	21	32	17	23	23	27	27	26	31	26	25	22
Middle Atlantic	123	160	198	257	297	347	348	398	358	419	425	468	486	469	489	421	381	322
New York	52	67	82	106	125	149	153	177	160	189	193	216	227	226	241	216	197	171
New Jersey	8	11	16	23	25	26	26	29	25	30	30	33	35	31	34	31	28	24
Pennsylvania	63	83	100	129	147	172	169	191	172	200	202	219	224	212	214	174	156	128
North Central	1,152	1,277	1,461	1,704	1,868	1,986	2,097	2,264	2,079	2,163	2,182	2,233	2,197	1,924	1,698	1,125	772	438
East North Central	513	574	666	799	885	954	1,006	1,084	967	1,052	1,085	1,123	1,136	1,009	985	762	587	368
Ohio	111	120	140	177	199	221	234	255	219	245	257	272	277	251	247	196	180	144
Indiana	101	108	128	154	167	176	185	201	182	196	205	215	222	198	194	161	132	94
Illinois	124	133	155	176	195	204	213	231	214	226	237	252	264	241	256	203	143	76
Michigan	78	94	112	139	156	175	188	197	169	192	196	207	203	172	154	99	62	34
Wisconsin	99	119	131	154	169	178	187	200	182	193	189	177	170	146	134	103	69	20
West North Central	639	704	795	905	983	1,032	1,091	1,180	1,113	1,111	1,097	1,110	1,061	916	713	363	185	69
Minnesota	111	131	146	166	179	189	197	203	185	188	178	156	155	117	92	47	18	(Z)
Iowa	140	154	175	193	203	209	213	222	215	213	213	217	229	202	185	116	61	15
Missouri	137	147	169	202	230	243	256	278	256	260	263	277	285	238	216	148	93	54
North Dakota	46	49	55	62	65	70	74	85	78	76	78	74	45	28	4	[1]2	-	-
South Dakota	46	50	56	63	66	69	72	83	83	80	75	78	53	50	14		-	-
Nebraska	72	80	90	101	107	112	121	134	129	128	124	130	122	114	63	12	3	-
Kansas	86	92	104	120	131	141	156	175	166	166	165	178	173	167	139	38	10	-
South	1,161	1,373	1,646	2,317	2,652	2,881	3,007	3,422	3,224	3,131	3,207	3,098	2,620	1,836	1,531	885	672	515
South Atlantic	371	468	592	859	959	1,043	1,019	1,147	1,058	1,108	1,159	1,112	962	750	644	374	302	248
Delaware	4	4	5	6	7	9	9	10	10	10	10	11	10	9	9	8	7	6
Maryland	17	21	25	33	36	41	42	44	43	49	48	49	46	41	41	27	25	22
District of Columbia	-	-	-	-	-	-	-	-	-	-	-	(Z)	(Z)	(Z)	(Z)	(Z)	(Z)	(Z)
Virginia	65	80	98	136	151	173	175	198	171	194	186	184	168	128	119	74	93	77
West Virginia	23	36	44	69	81	98	99	106	83	90	87	97	93	73	63	40		
North Carolina	119	148	191	268	289	287	278	301	280	283	270	254	225	178	158	94	75	57
South Carolina	40	58	78	124	139	148	138	166	158	173	193	176	155	115	94	52	33	30
Georgia	67	83	106	166	198	226	216	251	256	249	311	291	225	171	139	70	62	52
Florida	36	41	45	58	57	61	62	73	59	59	54	50	41	34	23	10	7	4
East South Central	392	468	563	790	913	960	1,023	1,137	1,062	1,006	1,052	1,042	903	656	570	372	271	223
Kentucky	125	133	151	193	218	239	253	278	246	259	271	259	235	179	166	118	91	75
Tennessee	121	133	158	203	232	234	248	274	246	253	253	246	225	174	166	118	82	73
Alabama	72	93	116	177	212	223	232	273	257	238	256	263	223	158	136	67	55	42
Mississippi	73	109	138	216	251	264	291	312	313	257	272	274	221	144	102	68	43	34
West South Central	398	436	491	668	780	878	964	1,138	1,103	1,017	996	943	755	431	317	139	99	43
Arkansas	60	80	95	145	182	199	217	253	242	222	233	215	179	125	94	49	39	18
Louisiana	42	62	74	111	124	129	150	170	161	132	135	121	116	69	48	28	17	13
Oklahoma	83	89	95	119	142	165	180	213	204	197	192	190	[1]108	[1]9	-	-	-	-
Texas	214	205	227	293	332	385	418	501	495	466	436	418	352	228	174	61	43	12
West	265	306	349	423	468	494	515	571	510	499	484	378	245	146	84	48	36	7
Mountain	120	134	149	180	195	213	233	271	241	233	244	183	101	49	25	14	9	5
Montana	25	27	29	33	36	38	42	51	47	47	58	26	13	6	2	1	-	-
Idaho	25	30	34	39	40	41	44	45	42	41	42	31	17	7	2	(Z)	-	-
Wyoming	9	9	10	11	13	13	15	17	16	16	16	11	6	3	(Z)	(Z)	-	-
Colorado	28	30	33	41	46	48	51	64	60	58	60	46	25	16	5	2	-	-
New Mexico	12	14	16	21	24	30	34	41	31	32	30	36	12	4	5	4	5	4
Arizona	6	6	7	9	10	13	18	19	14	11	10	9	6	1	1	(Z)	-	-
Utah	13	16	18	23	24	26	25	31	27	26	26	22	19	11	9	5	4	1
Nevada	2	2	2	3	3	3	4	4	3	4	3	3	2	1	1	1	(Z)	-
Pacific	145	171	200	243	273	282	282	300	268	266	240	194	144	98	59	34	26	2
Washington	34	46	52	65	70	80	82	84	71	73	66	56	33	18	7	3	1	-
Oregon	29	40	43	54	60	63	62	65	55	56	50	46	36	26	16	8	6	1
California	78	81	99	123	137	139	133	150	136	136	118	88	73	53	36	24	19	1
Alaska	(Z)	(Z)	(Z)	-	1	-	1	-	1	-	(Z)	(Z)	(Z)	-	-	-	-	-
Hawaii	4	5	6	-	6	-	5	-	5	-	5	4	2	-	-	-	-	-

See footnotes at end of table.

Table A-3. Land in Farms in the U.S., 1850-1969, By Division, Region, and State.

Division, region, and State	Land in farms (1,000 acres)																	
	1969	1964	1959	1954	1950	1945	1940	1935	1930	1925	1920	1910	1900	1890	1880	1870	1860	1850
United States	1,063,346	1,110,187	1,123,508	1,158,192	1,161,420	1,141,615	1,065,114	1,054,515	990,112	924,319	958,677	881,431	841,202	623,219	536,082	407,735	407,213	293,561
Northeast	25,683	31,979	36,047	41,019	44,402	48,903	47,010	51,919	49,330	53,349	57,564	62,906	65,409	62,744	67,986	62,744	61,082	55,163
New England	5,599	7,744	9,316	11,121	12,547	14,497	13,371	15,463	14,283	15,858	16,991	19,715	20,549	19,756	21,484	19,570	20,111	18,367
Maine	1,760	2,590	3,082	3,614	4,182	4,613	4,223	4,722	4,640	5,161	5,426	6,297	6,300	6,180	6,553	5,839	5,728	4,555
New Hampshire	613	903	1,124	1,457	1,714	2,017	1,809	2,116	1,960	2,262	2,604	3,249	3,610	3,459	3,721	3,606	3,745	3,392
Vermont	1,916	2,524	2,945	3,318	3,527	3,931	3,667	4,043	3,896	3,926	4,236	4,664	4,724	4,396	4,883	4,529	4,274	4,126
Massachusetts	701	902	1,142	1,439	1,660	1,978	1,838	2,196	2,006	2,368	2,494	2,876	3,147	2,998	3,359	2,730	3,339	3,356
Rhode Island	69	104	138	155	191	266	222	308	279	309	332	443	456	469	515	502	521	554
Connecticut	541	721	884	1,138	1,272	1,693	1,612	2,080	1,502	1,832	1,899	2,186	2,312	2,253	2,454	2,364	2,504	2,384
Middle Atlantic	20,085	24,235	26,730	29,898	31,855	34,406	33,639	36,455	35,047	37,491	40,573	43,191	44,860	42,988	46,502	43,175	40,971	36,795
New York	10,148	12,275	13,490	15,071	16,017	17,568	17,170	18,686	17,980	19,270	20,633	22,030	22,648	21,962	23,781	22,191	20,975	19,119
New Jersey	1,036	1,156	1,379	1,665	1,725	1,818	1,874	1,914	1,758	1,925	2,283	2,574	2,841	2,662	2,930	2,990	2,984	2,753
Pennsylvania	8,901	10,804	11,862	13,162	14,113	15,020	14,594	15,855	15,309	16,296	17,658	18,587	19,371	18,364	19,791	17,994	17,012	14,923
North Central	373,369	383,090	385,394	393,458	396,427	398,812	388,078	390,034	376,379	360,834	374,708	350,577	317,349	256,587	206,982	139,215	107,900	62,688
East North Central	94,607	99,486	103,386	108,597	112,098	115,564	113,655	116,957	110,891	112,752	117,735	117,929	116,341	105,787	105,785	87,449	72,697	50,189
Ohio	17,111	17,619	18,507	19,992	20,969	21,928	21,908	22,858	21,514	22,219	23,516	24,106	24,502	23,352	24,529	21,712	20,472	17,997
Indiana	17,573	17,933	18,618	19,233	19,659	20,027	19,801	20,519	19,689	19,916	21,063	21,300	21,620	20,363	20,421	18,120	16,388	12,793
Illinois	29,913	29,968	30,827	30,899	30,978	31,602	31,033	31,661	30,695	30,732	31,975	32,523	32,795	30,498	31,674	25,883	20,912	12,037
Michigan	11,901	13,599	14,783	16,467	17,270	18,392	18,038	18,460	17,119	18,035	19,033	18,941	17,562	14,786	13,807	10,019	7,031	4,384
Wisconsin	18,109	20,373	21,166	22,507	23,221	23,615	22,876	23,459	21,874	21,851	22,148	21,060	19,863	16,788	15,353	11,715	7,894	2,977
West North Central	278,761	283,603	282,007	284,861	284,329	283,248	274,423	273,077	265,488	248,081	256,973	232,648	201,009	150,800	101,198	51,766	35,203	12,499
Minnesota	28,846	30,805	30,796	32,285	32,883	33,160	32,607	32,818	30,913	30,059	30,222	27,676	26,248	18,664	13,403	6,484	2,712	29
Iowa	33,570	33,758	33,831	34,045	34,265	34,454	34,149	34,369	34,019	33,281	33,475	33,931	34,574	30,492	24,753	15,542	10,070	2,736
Missouri	32,420	32,692	33,165	34,195	35,123	35,278	34,740	35,055	33,743	32,642	34,775	34,591	33,998	30,780	27,879	21,707	19,985	9,733
North Dakota	43,118	42,717	41,466	41,877	41,194	41,001	37,936	39,118	38,658	34,327	36,215	28,427	15,543	7,660	1,028	[1] 302	[1] 26	...
South Dakota	45,584	45,567	44,851	44,949	44,786	43,032	39,474	37,102	36,470	32,018	34,636	26,017	19,071	11,396	2,773			...
Nebraska	45,834	47,793	47,766	47,487	47,467	47,753	47,344	46,616	44,709	42,025	42,225	38,622	29,912	21,593	9,945	2,074	631	...
Kansas	49,390	50,271	50,153	50,024	48,611	48,589	48,174	48,010	46,976	43,729	45,426	43,385	41,663	30,214	21,417	5,657	1,778	...
South	332,808	346,228	357,448	386,289	393,216	377,795	370,168	375,206	343,086	324,189	350,122	354,453	362,036	256,606	234,920	189,556	225,514	171,047
South Atlantic	68,031	76,959	83,339	98,259	102,170	96,601	92,555	95,987	86,363	88,571	97,776	103,782	104,298	100,158	101,420	90,213	106,521	93,402
Delaware	674	717	763	814	851	923	896	921	901	900	945	1,039	1,066	1,056	1,090	1,052	1,004	956
Maryland	2,803	3,181	3,457	3,897	4,056	4,200	4,198	4,384	4,374	4,433	4,758	5,057	5,170	4,952	5,120	4,513	4,836	4,634
District of Columbia	...	...	...	...	1	2	2	3	3	4	6	6	8	12	18	12	34	27
Virginia	10,650	12,002	13,126	14,686	15,572	16,358	16,445	17,645	16,729	17,210	18,561	19,496	19,908	19,105	19,836	18,146	31,117	26,152
West Virginia	4,341	5,279	6,063	7,352	8,215	8,720	8,909	9,424	8,802	8,980	9,570	10,026	10,655	10,321	10,194	8,528		
North Carolina	12,734	14,882	15,888	18,260	19,318	18,618	18,845	19,936	18,055	18,594	20,022	22,439	22,749	22,652	22,364	19,835	23,763	20,997
South Carolina	6,992	8,101	9,149	11,069	11,879	11,022	11,239	12,330	10,393	10,639	12,427	13,512	13,985	13,185	13,458	12,105	16,196	16,218
Georgia	16,806	17,887	19,658	24,019	25,761	23,676	23,684	25,297	22,079	21,946	25,441	26,953	26,392	25,200	26,043	23,648	26,650	22,821
Florida	14,032	15,411	15,237	18,162	16,528	13,084	8,338	6,048	5,027	5,865	6,047	5,254	4,364	3,674	3,297	2,374	2,920	1,596
East South Central	60,719	64,509	68,285	77,202	79,576	76,198	77,086	78,101	72,817	70,607	78,897	81,521	81,248	78,999	76,873	66,324	74,777	58,563
Kentucky	15,968	16,265	17,031	18,034	19,442	19,726	20,294	20,699	19,927	19,913	21,613	22,189	21,979	21,412	21,496	18,660	19,163	16,950
Tennessee	15,057	15,266	16,081	17,654	18,534	17,789	18,403	19,086	18,003	17,901	19,511	20,042	20,342	20,162	20,667	19,581	20,669	18,984
Alabama	13,654	15,226	16,543	20,810	20,889	19,068	19,143	18,661	17,555	16,739	19,577	20,732	20,685	19,853	18,855	14,961	19,105	12,138
Mississippi	16,040	17,752	18,630	20,702	20,711	19,617	19,156	19,656	17,332	16,053	18,197	18,558	18,241	17,573	15,855	13,121	15,840	10,490
West South Central	204,058	204,760	205,824	210,828	211,469	204,996	200,527	201,118	183,906	165,013	173,449	169,150	176,491	77,448	56,627	33,020	44,216	19,084
Arkansas	15,695	16,565	16,457	17,944	18,871	17,456	18,045	17,742	16,053	15,632	17,457	17,416	16,637	14,891	12,062	7,597	9,574	2,598
Louisiana	9,789	10,411	10,347	11,441	11,202	10,040	9,996	10,444	9,355	8,838	10,020	10,439	11,059	9,544	8,274	7,026	9,299	4,989
Oklahoma	36,008	36,077	35,801	35,629	36,007	36,162	34,803	35,335	33,791	30,869	31,952	28,859	[2] 22,988	[2] 1,606	...	...	...	...
Texas	142,567	141,706	143,218	145,813	145,389	141,338	137,683	137,597	124,707	109,674	114,021	112,435	125,807	51,407	36,292	18,397	25,344	11,496
West	331,486	348,890	344,620	337,426	327,377	316,105	259,857	236,356	221,316	185,947	176,283	113,495	96,407	47,282	26,194	16,219	12,718	4,664
Mountain	256,524	268,003	264,429	260,942	250,213	244,577	191,901	173,881	157,450	131,689	117,337	59,533	46,397	14,766	3,976	1,754	1,561	337
Montana	62,918	66,834	64,081	61,469	69,247	68,787	48,452	47,512	44,669	32,736	35,071	13,546	11,844	1,964	406	140	...	...
Idaho	14,417	15,302	15,232	14,364	13,221	12,503	10,298	9,962	9,347	8,116	8,376	5,284	3,205	1,302	328	77	...	...
Wyoming	35,476	37,053	36,200	34,989	34,421	33,117	28,026	28,162	23,625	18,663	11,809	8,543	8,125	1,830	124	4	...	...
Colorado	36,697	38,259	38,787	38,385	37,953	36,218	31,627	29,978	28,876	24,167	24,462	13,532	9,476	4,599	1,165	320	...	...
New Mexico	46,792	47,647	46,293	49,451	47,622	49,608	36,860	34,397	30,822	27,850	24,410	11,270	5,131	788	631	834	1,415	291
Arizona	38,203	40,569	40,203	41,790	29,916	27,856	25,681	14,019	10,527	11,065	5,802	1,247	1,935	1,297	136	22	...	...
Utah	11,313	12,857	12,689	12,262	10,865	10,309	7,302	6,239	5,613	5,001	5,050	3,398	4,117	1,324	656	148	90	47
Nevada	10,708	10,483	10,913	8,231	7,066	6,178	3,785	3,622	4,081	4,091	2,357	2,715	2,566	1,661	531	209	56	...
Pacific	74,962	80,887	80,191	76,484	77,164	71,529	67,956	62,476	63,866	54,258	58,946	53,962	50,009	32,516	22,218	14,465	11,157	4,327
Washington	17,559	19,053	18,717	17,641	17,369	16,720	15,182	14,670	13,574	12,610	13,246	11,712	8,499	4,179	1,409	649	366	...
Oregon	18,018	20,609	21,236	21,047	20,328	19,754	17,988	17,368	16,619	14,131	13,542	11,685	10,071	6,910	4,215	2,389	2,061	433
California	35,722	37,011	36,888	37,796	36,613	35,054	30,524	30,438	30,443	27,517	29,366	27,931	28,829	21,427	16,594	11,427	8,730	3,894
Alaska	1,604	1,859	888	...	422	...	1,776	...	628	...	91	43	(2)	...	...	...	...	...
Hawaii	2,058	2,354	2,461	...	2,432	...	2,486	...	2,618	...	2,702	2,591	2,610	...	...	...	...	...

See footnotes at end of table.

Table A-4. Average Acreage Per Farm in the U.S., 1850-1969, By Division, Region, and State.

Division, region, and State	Average acreage per farm (acres)																	
	1969	1964	1959	1954	1950	1945	1940	1935	1930	1925	1920	1910	1900	1890	1880	1870	1860	1850
United States	390	352	303	242	216	195	178	155	157	145	149	139	147	137	134	153	199	203
Northeast	169	158	142	121	112	98	97	93	102	92	99	96	97	95	98	104	108	113
New England	195	185	164	136	122	96	99	98	114	99	109	104	107	104	104	108	109	119
Maine	221	201	178	155	138	109	108	113	119	103	113	106	106	100	102	98	103	97
New Hampshire	211	194	172	140	128	107	109	120	132	107	127	120	123	119	116	122	123	116
Vermont	279	273	243	208	185	148	156	149	157	141	146	143	143	138	138	134	136	139
Massachusetts	123	113	102	83	76	66	61	63	78	71	78	78	83	87	88	103	94	99
Rhode Island	98	94	99	77	74	74	74	71	84	79	81	84	83	85	83	94	96	103
Connecticut	121	119	107	89	82	72	72	65	87	79	84	82	86	86	80	93	100	106
Middle Atlantic	163	151	135	116	107	99	97	92	98	90	95	92	92	92	95	103	106	114
New York	196	186	164	143	126	118	112	106	113	102	107	102	100	97	99	103	107	112
New Jersey	122	109	89	73	70	69	73	66	63	65	77	77	82	86	86	98	108	116
Pennsylvania	142	130	119	102	96	87	86	83	89	81	87	86	86	87	93	103	109	117
North Central	324	300	284	231	212	201	185	172	181	167	172	157	145	133	122	124	140	143
East North Central	184	173	156	136	127	121	113	108	116	107	109	106	102	105	107	115	124	138
Ohio	154	146	132	113	106	99	94	90	98	91	92	89	89	93	99	111	114	126
Indiana	173	160	146	125	118	114	107	102	108	102	103	99	97	103	105	112	124	136
Illinois	242	226	196	173	169	166	146	137	143	130	136	129	124	127	124	128	146	168
Michigan	163	145	132	119	111	106	96	94	101	94	97	92	86	86	90	101	113	129
Wisconsin	183	172	161	147	138	133	123	117	120	113	117	119	117	115	114	114	114	145
West North Central	437	403	355	316	289	275	262	231	239	223	234	210	190	165	142	143	190	180
Minnesota	261	235	211	195	184	175	165	161	167	160	169	177	170	160	145	139	149	184
Iowa	239	219	194	177	169	165	160	156	158	156	157	166	161	151	134	134	165	165
Missouri	237	222	197	170	153	145	136	126	132	125	132	125	119	129	129	146	215	179
North Dakota	930	876	756	676	630	590	513	462	496	452	466	382	343	277	271	[1]170	[1]215	--------
South Dakota	997	917	805	719	674	626	545	445	439	403	464	335	362	227	203			--------
Nebraska	634	596	528	471	443	427	391	349	345	329	339	298	246	190	157	169	226	--------
Kansas	574	544	481	416	370	344	308	272	283	264	275	244	241	181	155	148	171	--------
South	207	252	217	167	148	131	123	110	106	104	109	114	138	140	153	214	335	332
South Atlantic	184	164	141	114	107	93	91	84	82	80	84	93	108	134	157	241	363	376
Delaware	182	163	148	129	114	99	100	89	93	88	93	96	110	113	126	138	161	168
Maryland	163	153	138	120	112	102	100	99	101	91	99	103	112	121	126	167	190	212
Virginia	165	149	136	108	103	95	94	83	98	89	100	106	119	150	167	246	336	340
West Virginia	188	153	138	107	101	89	90	90	107	99	110	104	115	142	163	214		
North Carolina	107	97	83	68	67	65	68	66	65	66	74	88	101	127	142	212	316	369
South Carolina	177	144	117	89	85	78	82	76	66	62	65	77	96	115	143	233	488	541
Georgia	234	215	186	146	130	106	110	101	86	88	82	93	118	147	188	338	430	441
Florida	394	380	338	316	290	214	134	83	86	99	112	105	107	107	141	232	444	371
East South Central	166	138	121	98	87	79	75	70	69	70	75	78	90	121	135	175	276	262
Kentucky	128	122	113	93	89	83	80	74	81	77	80	86	94	115	129	158	211	227
Tennessee	124	114	102	87	80	78	76	70	73	71	77	82	91	116	125	166	261	261
Alabama	188	165	143	118	99	85	83	72	68	70	76	79	93	126	139	222	347	289
Mississippi	221	163	135	96	82	74	66	63	56	62	67	68	83	122	166	193	370	309
West South Central	611	469	419	316	271	234	208	177	167	162	174	179	234	180	179	238	416	440
Arkansas	260	207	173	124	103	88	83	70	66	70	75	81	93	119	128	164	245	146
Louisiana	232	167	139	103	90	78	67	61	58	[illegible]	74	87	95	138	171	247	537	372
Oklahoma	434	407	378	300	263	219	194	166	166	157	166	152	[2]213	[2]182	--------	--------	--------	--------
Texas	668	591	631	498	439	367	329	276	252	236	262	269	357	225	208	301	591	942
West	1,260	1,142	987	798	700	639	564	414	434	373	364	300	393	324	313	336	367	636
Mountain	2,139	1,998	1,774	1,460	1,284	1,151	822	641	653	564	481	325	458	299	169	127	177	72
Montana	2,622	2,437	2,213	1,859	1,689	1,557	1,111	940	940	658	608	517	886	351	267	164	--------	--------
Idaho	566	616	462	371	328	301	236	221	224	200	199	172	183	197	174	186	--------	--------
Wyoming	4,014	4,100	3,715	3,069	2,729	2,533	1,866	1,610	1,469	1,203	760	778	1,333	686	272	26	--------	--------
Colorado	1,313	1,284	1,162	942	833	761	613	471	482	417	408	293	384	281	259	184	--------	--------
New Mexico	4,020	3,254	2,908	2,347	2,014	1,671	1,139	832	982	879	818	316	417	177	125	186	278	70
Arizona	6,486	6,262	5,668	4,483	3,834	2,881	1,389	746	743	1,024	682	136	333	910	177	127	--------	--------
Utah	867	617	712	537	419	392	287	203	207	192	197	157	212	126	69	30	26	51
Nevada	5,070	4,862	4,649	2,881	2,271	1,802	1,059	980	1,186	1,084	745	1,010	1,175	1,301	378	201	617	--------
Pacific	516	472	401	(NA)	283	(NA)	241	(NA)	238	(NA)	248	278	348	337	379	420	432	2,126
Washington	516	418	363	271	249	209	186	174	191	172	200	208	256	231	216	208	275	--------
Oregon	620	516	499	387	340	313	291	268	300	263	270	257	281	271	260	316	355	372
California	459	458	372	307	267	262	230	202	224	202	260	317	397	406	462	482	466	4,466
Alaska	4,832	5,129	2,421	--------	803	--------	2,860	--------	1,062	--------	249	192	13	--------	--------	--------	--------	--------
Hawaii	528	484	394	--------	473	--------	498	--------	428	--------	611	600	1,148	--------	--------	--------	--------	--------

See footnotes at end of table.

Table A-5. Average Value of Farm Property Per Farm in the U.S., 1850-1969, By Division, Region, and State.

Division, region, and State	Average value per farm (dollars)																	
	1969	1964	1959	1954	1950	1945	1940	1935	1930	1925	1920	1910	1900	1890	1880	1870	1860	1850
United States	75,725	50,646	34,768	20,405	14,005	7,917	5,532	4,823	7,624	7,764	10,295	6,480	2,905	2,909	2,544	2,799	3,261	2,258
Northeast	59,426	34,130	24,702	15,950	11,771	6,685	5,781	5,473	7,789	6,407	6,738	4,611	3,656	3,856	4,027	4,201	3,756	2,971
New England	62,937	34,162	24,860	15,303	11,839	6,244	5,478	(NA)	(NA)	5,678	5,860	3,806	2,753	2,677	2,802	2,691	2,689	2,221
Maine	35,496	19,979	14,756	9,392	7,462	3,765	3,183	3,425	4,981	3,943	4,232	2,660	1,627	1,589	1,692	1,377	1,413	1,173
New Hampshire	50,418	25,402	18,046	11,989	9,323	4,280	3,768	3,783	5,190	4,113	4,385	3,176	2,391	2,270	2,356	2,175	2,285	1,890
Vermont	62,347	29,733	19,837	12,662	10,314	5,080	4,712	4,286	5,861	4,940	5,473	3,442	2,509	2,469	3,078	3,296	2,988	2,129
Massachusetts	69,362	43,492	31,692	[illegible]	14,163	7,167	6,647	7,285	10,205	7,611	7,737	5,260	4,190	3,710	3,807	3,515	3,462	3,202
Rhode Island	72,033	46,030	37,571	[illegible]	17,062	9,883	8,737	8,144	10,388	7,139	6,463	5,278	4,206	3,977	4,164	3,215	3,616	3,170
Connecticut	111,071	67,429	47,372	25,971	20,189	11,826	9,576	8,828	13,226	8,689	8,399	5,158	3,616	3,605	3,957	3,897	3,607	3,240
Middle Atlantic	58,609	33,964	24,657	16,156	11,747	6,875	5,858	...	...	5,684	7,061	5,216	4,013	4,374	4,546	4,892	4,319	3,361
New York	53,399	32,797	23,936	15,844	11,742	7,275	6,180	5,906	8,234	7,243	7,376	5,496	3,917	4,280	4,381	4,709	4,078	3,250
New Jersey	133,202	73,487	46,397	29,635	20,343	11,171	8,818	7,977	11,776	8,848	8,428	6,484	4,692	5,166	5,564	6,721	6,520	5,030
Pennsylvania	52,829	29,836	21,892	14,039	10,299	5,872	5,113	4,505	6,977	5,838	6,560	4,747	4,006	4,359	4,669	4,796	4,234	3,197
North Central	75,002	50,244	37,974	25,010	18,065	11,116	7,693	7,061	11,781	12,740	18,063	9,174	4,364	3,675	3,021	3,068	2,758	1,716
East North Central	71,466	48,666	37,132	23,717	16,607	10,441	7,289	(NA)	(NA)	10,483	13,771	7,899	4,325	4,066	3,683	3,476	2,958	1,824
Ohio	61,251	43,373	32,583	20,937	14,341	8,470	6,176	5,007	7,720	7,951	10,308	6,080	3,746	4,176	4,561	4,306	3,770	2,495
Indiana	70,316	51,646	38,489	24,303	16,161	10,197	6,781	5,180	7,796	8,661	12,937	7,899	3,793	3,809	3,274	3,149	2,706	1,453
Illinois	118,507	80,894	61,946	40,083	27,628	17,933	11,887	9,536	15,553	18,615	25,289	13,986	5,684	5,247	3,948	3,631	2,864	1,261
Michigan	49,821	34,027	25,535	15,800	10,936	6,843	4,805	4,205	6,853	6,676	7,313	4,364	2,866	3,227	3,241	3,225	2,577	1,622
Wisconsin	42,448	26,765	21,309	14,789	12,203	8,069	6,365	6,238	9,526	9,830	11,668	6,784	4,041	3,262	2,663	2,336	1,893	1,414
West North Central	77,845	51,539	38,680	26,161	19,379	11,739	8,065	...	...	14,876	22,307	10,464	4,385	3,245	2,105	2,215	2,126	1,163
Minnesota	58,803	39,075	32,605	21,061	15,607	9,705	7,312	6,803	11,471	12,717	18,496	8,085	4,329	2,910	2,097	1,683	1,613	1,032
Iowa	93,894	59,563	49,150	35,090	27,105	17,284	12,614	11,092	19,655	23,207	35,616	15,008	6,650	4,247	3,061	2,701	1,960	1,128
Missouri	53,034	33,451	22,094	13,815	9,720	6,285	4,324	3,948	7,018	7,691	11,646	6,190	2,963	2,629	1,742	2,119	2,485	1,161
North Dakota	87,222	58,460	38,978	24,110	18,178	10,189	6,628	5,368	12,199	13,428	19,160	11,063	4,385	2,728	2,263	[1]970	[1]784	...
South Dakota	83,427	56,015	40,852	28,263	21,096	11,124	6,970	8,306	15,456	18,071	33,132	12,945	4,183	2,143	1,013			...
Nebraska	97,931	65,768	46,798	33,713	25,617	16,205	9,399	11,696	19,274	19,760	29,836	13,983	4,763	3,542	1,671	1,967	1,391	...
Kansas	91,131	56,397	45,084	33,117	24,344	13,962	9,092	8,469	13,738	13,250	17,122	9,770	3,718	3,369	1,697	1,892	1,179	...
South	59,983	37,931	23,702	12,766	8,654	4,564	3,231	2,553	3,829	3,085	4,727	2,374	1,251	1,402	1,224	1,456	3,485	2,051
South Atlantic	55,335	34,496	21,671	11,123	7,466	4,062	3,099	(NA)	(NA)	3,699	4,488	2,236	1,254	1,516	1,384	1,632	3,340	2,329
Delaware	90,632	53,443	34,561	20,287	13,043	7,820	6,104	4,969	6,896	5,618	6,386	4,906	3,555	4,220	4,205	4,907	4,720	3,114
Maryland	104,370	64,999	39,095	21,258	14,048	8,596	6,606	6,465	8,244	6,966	8,070	4,941	3,807	4,291	4,085	6,048	5,726	3,988
District of Columbia	...	...	...	...	166,643	24,034	91,429	60,709	68,690	34,500	27,340	37,932	41,911	16,940	8,350	14,546	12,560	6,481
Virginia	47,191	27,672	18,035	11,369	8,468	5,021	3,960	5,005	5,016	4,578	6,501	2,891	1,618	1,994	1,823	2,308	4,014	2,810
West Virginia	26,460	13,882	10,230	7,248	5,983	3,494	2,718	2,269	4,138	3,941	4,706	2,735	1,812	2,087	2,124	2,043		
North Carolina	35,561	24,442	18,476	8,758	6,605	3,490	2,647	2,069	3,018	3,267	3,990	1,800	867	1,031	862	669	1,908	1,192
South Carolina	46,171	24,948	15,685	7,769	5,896	2,982	2,461	1,726	2,401	2,649	4,222	1,887	816	862	732	691	4,210	2,751
Georgia	64,883	29,155	17,944	8,710	6,623	2,896	2,223	1,716	2,259	2,369	3,663	1,647	816	889	807	1,081	2,633	1,850
Florida	139,818	109,053	73,654	83,627	16,617	8,149	5,211	4,407	7,179	5,088	5,212	2,362	1,000	2,125	866	777	2,502	1,469
East South Central	37,135	21,897	13,962	7,709	5,662	3,224	2,272	...	...	2,466	3,484	1,668	1,034	1,262	1,190	1,461	3,428	1,666
Kentucky	32,309	22,235	16,269	8,900	7,196	4,259	3,070	2,229	3,535	3,278	4,823	2,462	1,628	1,932	1,798	2,103	3,210	2,073
Tennessee	33,176	20,509	13,288	8,049	6,182	2,715	2,683	2,030	3,025	3,006	4,056	1,953	1,180	1,392	1,248	1,481	3,294	1,346
Alabama	37,596	20,552	12,780	6,816	4,809	2,506	1,764	1,347	1,962	1,746	2,123	1,096	603	704	581	804	3,189	1,533
Mississippi	51,611	[illegible]	[illegible]	7,053	4,566	2,457	1,632	1,190	1,818	1,786	2,903	1,218	633	883	912	961	4,453	1,612
West South Central	86,681	[illegible]	37,306	20,817	13,616	6,626	4,388	...	...	4,876	6,316	3,317	1,609	1,421	958	969	3,876	2,481
Arkansas	67,532	[illegible]	18,915	9,496	6,225	3,334	2,108	1,486	2,261	2,436	3,230	1,440	757	960	786	648	2,350	860
Louisiana	74,414	38,630	23,719	11,497	7,416	3,653	2,369	1,736	2,590	2,461	3,499	1,971	1,217	232	1,222	1,916	11,818	5,649
Oklahoma	74,838	49,212	31,710	16,961	13,016	6,713	4,625	5,677	6,096	5,318	7,104	3,884	[1]1,582	[1]972	...	...	...	...
Texas	99,133	77,766	51,787	30,711	20,263	9,286	6,196	5,137	7,260	6,640	8,486	4,412	1,964	1,753	979	787	2,054	1,357
West	157,179	120,383	80,870	47,334	30,629	15,853	9,962	8,928	14,518	13,364	18,455	10,271	5,329	7,506	4,669	3,662	2,033	1,295
Mountain	145,486	101,780	72,967	43,191	28,294	12,969	7,623	(NA)	(NA)	9,310	12,959	7,192	3,342	4,019	2,319	651	493	420
Montana	150,222	103,271	76,761	44,653	28,475	13,720	8,373	7,433	11,199	9,709	15,468	9,599	4,639	4,553	2,129	685	...	...
Idaho	93,916	68,178	50,528	33,466	22,520	11,888	7,708	6,814	10,012	9,197	13,811	7,965	2,422	2,640	1,503	952	...	...
Wyoming	163,529	115,356	79,447	46,936	36,060	17,746	10,585	9,537	12,919	11,132	14,907	8,912	4,424	4,627	1,829	83	...	...
Colorado	124,180	90,183	61,494	37,613	26,588	11,866	7,550	6,580	10,497	10,211	14,449	8,848	4,306	5,189	5,572	1,668	...	...
New Mexico	168,836	117,042	88,233	50,078	30,228	11,004	5,498	4,113	6,619	5,529	7,432	5,136	1,807	1,826	1,091	404	632	441
Arizona	452,241	330,649	269,724	116,339	67,996	21,906	8,321	7,047	12,999	13,332	17,276	5,125	2,355	5,066	1,471	750	...	...
Utah	79,705	57,747	42,391	26,632	19,492	9,947	6,074	5,157	8,136	7,395	9,499	5,423	2,619	2,701	1,483	375	367	837
Nevada	270,507	182,436	141,974	78,162	43,700	20,985	13,321	11,518	18,626	17,512	20,947	14,730	7,150	9,662	3,852	1,434	3,322	...
Pacific	166,834	134,929	[1]89,632	60,406	31,266	18,028	11,720	(NA)	(NA)	16,926	19,941	13,050	6,761	9,291	3,672	4,866	2,559	3,302
Washington	115,487	64,304	47,590	31,018	21,057	11,268	7,264	6,527	10,911	9,921	13,886	10,179	5,482	4,622	2,120	1,272	1,668	...
Oregon	93,134	59,079	43,608	30,178	20,327	11,054	7,712	6,922	11,438	11,019	13,449	10,012	5,693	4,537	3,509	2,946	2,618	2,448
California	217,730	214,660	131,212	69,620	41,192	25,084	16,331	16,466	25,203	23,111	26,122	16,447	9,769	10,100	7,293	5,963	2,503	4,443
Alaska	61,641	47,150	48,379	...	12,465	...	6,165	...	5,714	...	3,329	3,908	...	...	...	...	...	...
Hawaii	156,800	98,930	(NA)	...	33,961	...	22,580	...	18,711	...	24,438	19,197	26,410	...	...	...	...	...

See footnotes at end of table.

Table A-6. Value of Farm Products Sold, U.S. Farms, 1925-1969, By Division, Region, and State.

Division, region, and State	Value of farm products sold (mil. dol.)								
	1969	1964	1959	1954	1950	1945	1940	1930	1925 [4]
United States	45,609	35,292	30,493	24,646	22,217	16,231	6,682	9,610	858
Northeast	2,822	2,575	2,292	2,049	1,922	1,490	723	978	71
New England	683	716	593	535	532	425	208	278	21
Maine	198	256	171	140	126	98	42	81	4
New Hampshire	49	49	48	46	46	39	19	24	(Z)
Vermont	136	115	109	86	87	70	33	48	4
Massachusetts	139	139	126	125	135	115	63	68	4
Rhode Island	16	19	18	15	16	15	8	9	1
Connecticut	146	139	120	123	121	89	44	48	8
Middle Atlantic	2,138	1,859	1,699	1,514	1,391	1,066	516	699	50
New York	979	853	755	668	630	504	242	343	38
New Jersey	214	215	231	242	214	166	74	83	2
Pennsylvania	945	791	713	604	546	396	198	273	10
North Central	20,097	14,838	13,002	10,647	9,733	7,047	2,923	4,140	437
East North Central	7,544	6,105	5,203	4,594	4,044	2,953	1,302	1,608	145
Ohio	1,246	1,013	863	844	712	533	254	315	28
Indiana	1,400	1,105	946	906	732	492	217	265	17
Illinois	2,612	2,123	1,811	1,506	1,362	954	415	455	53
Michigan	829	766	623	546	474	366	178	227	20
Wisconsin	1,456	1,097	961	793	765	608	239	346	27
West North Central	12,553	8,733	7,799	6,053	5,689	4,094	1,620	2,531	292
Minnesota	1,748	1,376	1,212	984	961	637	301	361	73
Iowa	3,656	2,597	2,284	1,840	1,636	1,152	512	621	81
Missouri	1,460	1,053	1,012	734	720	506	215	329	33
North Dakota	749	570	469	376	401	365	100	194	17
South Dakota	958	629	514	436	430	286	96	212	19
Nebraska	2,165	1,334	1,198	881	778	543	192	398	33
Kansas	1,818	1,175	1,111	802	765	604	204	418	37
South	13,354	10,586	8,884	7,025	6,359	4,632	1,921	2,903	199
South Atlantic	4,874	4,142	3,248	2,631	2,125	1,735	700	922	73
Delaware	129	108	86	82	76	62	16	18	(Z)
Maryland	340	276	231	196	172	137	56	77	7
District of Columbia	...	...	...	...	1	1	1	(Z)	...
Virginia	570	470	424	364	310	248	108	155	21
West Virginia	108	92	99	90	82	65	30	53	1
North Carolina	1,196	1,068	797	733	557	489	199	221	13
South Carolina	362	349	303	252	214	192	87	117	9
Georgia	1,040	826	607	448	375	302	122	197	9
Florida	1,132	954	700	466	339	240	80	83	13
East South Central	2,749	2,382	1,972	1,542	1,371	1,082	428	727	50
Kentucky	770	592	518	425	417	338	128	170	28
Tennessee	623	529	475	353	341	247	107	162	7
Alabama	670	537	414	304	274	213	77	165	7
Mississippi	685	724	566	460	340	284	116	230	8
West South Central	5,731	4,063	3,664	2,853	2,863	1,816	793	1,255	76
Arkansas	973	830	639	492	393	269	118	187	7
Louisiana	496	407	335	310	246	178	90	137	9
Oklahoma	969	601	581	409	471	369	146	264	21
Texas	3,293	2,225	2,109	1,642	1,753	1,000	439	666	39
West	9,337	7,293	6,315	4,924	4,203	3,062	1,115	1,589	151
Mountain	3,839	2,537	2,356	1,810	1,631	1,068	449	672	35
Montana	676	390	377	339	279	223	84	129	3
Idaho	650	478	438	332	281	216	84	127	3
Wyoming	249	161	102	115	122	83	46	59	1
Colorado	1,101	612	680	380	426	251	102	177	21
New Mexico	369	227	197	165	165	82	43	56	3
Arizona	611	469	338	328	204	95	39	47	2
Utah	213	159	166	127	130	97	40	59	2
Nevada	81	61	57	34	34	23	11	19	(Z)
Pacific	5,498	4,756	3,959	3,113	2,571	1,994	666	916	116
Washington	771	637	569	506	366	354	117	184	21
Oregon	531	428	412	346	298	239	99	125	8
California	3,904	3,499	2,822	2,261	1,742	1,400	452	608	87
Alaska	4	4	3	...	2	...	...	...	...
Hawaii	288	188	152	...	165	...	...	...	...

NA Not available.
Z Less than 500 or $500,000.
[1] Dakota Territory.

[2] Oklahoma Territory and Indian Territory.
[3] Oklahoma Territory only.
[4] Products sold through cooperative marketing organizations only.

APPENDIX B. CORRELATION MATRIXES

TABLE B1. SIMPLE CORRELATIONS AMONG FARM SECTOR, POPULATION, AND NONFARM CONTEXTUAL VARIABLES[1]

All Nonmetropolitan Counties (N=105)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. CORPORATE	-										
2. FULLOWN	.36*	-									
3. PART-TIME	-.10	-.08	-								
4. WORKFARM	.29*	.18	-.10	-							
5. CHEMICALS	-.25*	-.30*	.13	-.43*	-						
6. MACHINERY	.17	-.15	-.23*	.27*	-.06	-					
7. SALES	-.18	-.03	-.09	.62*	-.25*	.33*	-				
8. NFEMPLOY	.03	.22*	-.10	.16	-.02	-.09	.24*	-			
9. URBAN	.21*	.26*	.00	.14	-.09	.05	-.02	.17	-		
10. WORKERS	.07	-.12	-.11	.69*	-.23*	.37*	.59*	.02	.00	-	
11. FARMPOP	-.02	.12	-.06	.04	.11	-.27*	.07	.18	-.09	-.20*	-
12. RURALPOP	-.09	-.04	-.15	-.08	-.11	-.03	-.06	-.04	.07	-.11	-.07

Agricultural Counties (N=30)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. CORPORATE	-										
2. FULLOWN	-.01	-									
3. PART-TIME	.26	.03	-								
4. WORKFARM	-.10	.24	.00	-							
5. CHEMICALS	.07	-.04	.26	-.62*	-						
6. MACHINERY	.28	-.11	-.09	.01	.15	-					
7. SALES	-.23	.23	-.02	.84*	-.62*	-.08	-				
8. NFEMPLOY	-.34	-.04	-.16	.18	-.19	-.40*	.29	-			
9. URBAN	.34	.08	.06	.01	-.01	.03	-.09	.18	-		
10. WORKERS	-.09	.15	.03	.81*	-.58*	.05	.76*	.18	.12	-	
11. FARMPOP	-.24	.19	-.16	.22	-.07	-.09	.34	.23	-.53*	.14	-
12. RURALPOP	.26	.23	.24	.06	-.12	-.40*	.12	.27	.37*	.13	-.06

---

[1] Correlation coefficients are Pearson-r statistics. Those significant at a .05 level of probability are labelled "*." All variables except NFEMPLOY, URBAN, and SALES were computed as simple gain scores measuring differences over a ten-year period. NFEMPLOY measures the percentage of a county labor force employed in manufacturing and services in 1970. URBAN measures the urban percentage of a county population in 1970. SALES measures the percentage change in gross farm sales between 1969 and 1978.

TABLE B2. SIMPLE CORRELATIONS AMONG VARIABLES IN THE MODELS FOR COMMUNITY WELL-BEING[1]

All Nonmetropolitan Counties (N=105)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. POVERTY	-												
2. INCOME	-.39*	-											
3. RETAIL	-.06	.22*	-										
4. HOUSING	-.12	.07	.00	-									
5. TAXES	.30*	-.02	.14	-.29*	-								
6. RURALPOP%	.02	.01	-.03	.07	-.20*	-							
7. FARMPOP%	.07	.31*	.50*	.14	.02	-.01	-						
8. CORPORATE	.08	.05	-.11	-.12	-.02	-.04	.06	-					
9. FULLOWN	-.19*	.25*	.02	.13	-.20*	.01	.24*	.36*	-				
10. PART-TIME	-.15	.20*	.25*	.09	.10	-.14	.09	-.10	-.08	-			
11. WORKFARM	-.05	.07	-.11	.07	-.19*	.00	.02	.29*	.18	-.10	-		
12. SALES	-.09	.08	-.11	.17	-.34*	.11	.03	-.18	-.03	-.09	.62*	-	
13. NFEMPLOY	.01	.11	-.09	.33*	-.46*	.26*	.18	.03	.22*	-.10	.16	.24*	-
14. URBAN	.14	.26*	.24*	.27*	-.01	.23*	.48*	.21*	.26*	.00	.14	-.02	.17

Agricultural Counties (N=30)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. POVERTY	-												
2. INCOME	-.52*	-											
3. RETAIL	-.03	.29	-										
4. HOUSING	-.36*	.24	.08	-									
5. TAXES	.10	-.24	-.17	-.46*	-								
6. RURALPOP%	.15	-.01	.04	.39*	-.14	-							
7. FARMPOP%	.07	.42*	.59*	.32	-.33	.12	-						
8. CORPORATE	.28	-.19	.35	-.30	.31	-.02	.18	-					
9. FULLOWN	-.06	.41*	-.06	.12	-.06	.17	.38*	-.01	-				
10. PART-TIME	.27	.05	.47*	-.18	.07	.06	.23	.26	.03	-			
11. WORKFARM	-.38*	.38*	.23	.12	.00	.01	.30	-.10	.24	.00	-		
12. SALES	-.33	.51*	.27	.11	-.31	-.03	.37*	-.23	.23	-.02	.84*	-	
13. NFEMPLOY	.08	.18	-.03	.45*	-.58*	.39*	.31	-.34	-.04	-.16	.18	.29	-
14. URBAN	.22	-.06	.30	.45*	-.04	.49*	.46*	.34	.08	.06	.01	-.09	.18

---

[1] Correlation coefficients are Pearson-r statistics. Those significant at a .05 level of probability are labelled "*." All variables except NFEMPLOY, URBAN, and SALES were computed as simple gain scores measuring differences over a ten-year period. NFEMPLOY measures the percentage of a county labor force employed in manufacturing and services in 1970. URBAN measures the urban percentage of a county population in 1970. SALES measures the percentage change in gross farm sales between 1969 and 1978.

Background Paper No. 5

Examining Policy and Emerging Technologies Affecting Farm Structure in the South and the Interaction Between Farm Structure and Well-being of Rural Communities

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University of Kentucky

August 1985

Office of Technology Assessment
U.S. Congress

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

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SUMMARY OF PUBLIC POLICY FOR FARM STRUCTURE AND RURAL WELL-BEING IN THE SOUTH

An analysis of social and economic development and change in the South presents unique problems and challenges. This is particularly the case for its nonmetropolitan counties that have been on the periphery of national prosperity since the Colonial period. The legacies of times past are apparent in the current structure of southern agriculture, as are the influences of modern market structures. In recent decades, southern agriculture has become more concentrated, and indications are that the rate of concentration could accelerate in the foreseeable future. How technology will facilitate further concentration and its consequences for farm structure, as well as how continued concentration of farming will influence rural community well-being is the subject of this study. There are two principal foci of this report. First, the economic and social forces generating farm concentration are examined, with particular emphasis given to agricultural technologies. Second, the manner in which farm structural changes may influence the economic and social well-being of rural people is explored, with attention given to rural employment, poverty, and family income. The reader is encourage to look at the three appendices. Each appendix provides an elaboration of key discussions in the manuscript, and for the most part these discussions do not overlap with the text.

This report examines the historical context of the uneven development of modern social and economic institutions in the rural South and the ways in which antebellum methods of producing agricultural commodities continue to influence farming today. The historical evidence of the character and cause of uneven development and the consequences for nonmetropolitan counties in the South is overwhelming. In 1979, over ninety percent of the persistent low income nonmetropolitan counties in the U.S. were located in the South. The farm structure of the South continues to reflect the antebellum tensions between large-scale plantation operations and small independent family farming. In 1982, approximately 35 percent of the nation's farms with sales of less than $10,000 and 27 percent of all farms were located in the South. Yet, only 17 percent of the nation's agricultural output comes from the South. By far the largest concentration of small farms occurs in the South, particularly in the Appalachian and tobacco producing states. About 21 percent of all the nation's farms with sales exceeding $250,000 are in the South indicating the presence of a substantial large farm sector. The bifurcated farm structure in evidence elsewhere in the U.S. can be found in the South.

The nonmetropolitan South is the most underdeveloped region in the U.S. In 1980, 17.6 percent of the families were classified as living in poverty, while the rest of the U.S. nonmetropolitan counties averaged 11.8 percent. The reader should bare in mind that in discussions of community well-being that social and economic conditions in the rural South presently are not good. Therefore, when evidence of little change or the potential for even worse conditions are discussed, the relative differences generally mean a continuation of or a worsening of already unacceptably low standards of living for many rural southerners.

The discussion of the economic, social, and political forces shaping U.S. agriculture is presented in Section 2. Attention is given to agricultural technologies, which are conceived of as facilitating farm concentration. This is an important conceptual position since it represents a clear rejection of the popular notion of technological determinism. It is the marketplace that creates the incentives for resource-saving technologies. Agricultural technologies have not been developed independently of market conditions, and their use is in the context of market demands for increased productivity and the recurring necessity to expand farm scale. Cochrane's notion of a technological treadmill is advanced as an alternative explanation of the role of technological development and change.

The conceptual framework briefly articulates the forces shaping modern farming, and presents a model of how federal farm policies may inadvertently contribute to the acceleration of concentration among the largest farms while slowing the decline of smaller economically marginal farms. A principal theme of this section is the economic necessity in the past for farmers to expand their operations, and the apparent contradictory consequence at an aggregate level for increases in both productivity and total production to contribute to overproduction and low farm prices. Furthermore, the consequences of expanding farm scales are discussed. Emphasis is given the emergence of larger-than-family and industrial-type farms that are dependent upon hired labor. These changes in farm workplaces eventually may have adverse affects for rural society.

This report includes basic research on both the correlates of farm structure change and community well-being. The models and results of farm structure change are presented in Appendix C (not in the primary text). These findings strongly support the conceptual framework. In particular, both labor- and land-saving technologies are reported to influence both current structure and past change. In addition, it is noted that conditions presently exist in the coastal areas for the introduction of large-scale industrial farm operations.

The South raises a wide variety of agricultural commodities. Six of these commodities receive attention. Among these commodities the extremes in farm structure is evident. Commodities like cotton and poultry appear to be highly concentrated while tobacco and beef are raised primarily on small family farms.

The examination of how farm structure is associated with community well-being assumes that farm technological changes are reflected in structural changes. The literature addressing the association between farm and community change is reviewed in both Section 3 and Appendix B. Two models are discussed. The first model assumes a negative linear relationship between increased farm scale and community well-being. This is the widely acclaimed Goldschmidt model which proposes that rural areas dominated by an industrial farming hinterland will be characterized by poor economic and social conditions. The second model assumes a curvilinear relationship approximating an inverted "U". This model is proposed in a companion study by MacCannell and Dolber-Smith which examines industrial farm states. Their hypothesis is that as farm concentration increases from very small operations to medium-sized operations community well-being is enhanced. However, at an undetermined point further increases in farm scale, particularly as dependency on hired labor increases, community well- being will be adversely affected.

The findings suggest that between 1970 and 1980 farm concentration was differentially associated with community well-being. The strongest association was between a county's average farm scale and level of unemployment. However, rather than a linear relationship, as might be suggested by the Goldschmidt hypothesis, a curvilinear ("U" shaped) relationship was observed, with medium average size farms being associated with low levels of unemployment. Furthermore, counties which had the largest increase in average farm scale were more likely to have an increase in the percent of families below poverty. The remaining farm structure and community well-being variables were not associated in a manner consistent with the Goldschmidt hypothesis. There was evidence, though, that further concentration in farm structure, characterized by very large farms dependent upon hired labor, could be associated with adverse effects on community well-being.

The most interesting aspects of the community well-being models were the influences of nonfarm industries on a county's well-being. The South's nonmetropolitan county's are primarily dependent upon manufacturing and service industries for employment. In 1980, 46.1 percent of the labor force among these counties was employed in either manufacturing or service industries. (Another 7.8 percent of the labor force was unemployed.) The findings suggest that manufacturing industries, while associated with low levels of unemployment, were also associated with lower median family income. Service industries were associated with low levels of median family income and high levels of poverty. These findings indicate a Faustian dilemma for nonmetropolitan Southern counties. In order to employ their labor forces they need to attract nonfarm industries, yet the type of industries they tend to attract are peripheral and often vulnerable to third-world competition. These industries have sought locations in Southern nonmetropolitan counties because of the highly segmented unskilled and semi-skilled labor force which will accept low wages and is generally unorganized.

The discussion of both farm and community well-being informs several policy recommendations. First, the nonmetropolitan South is relatively underdeveloped in comparison with other nonmetropolitan counties in the U.S. In order for these counties to participate in our national prosperity a comprehensive rural development program is necessary. Such a program should emphasize (1) a job program and income support, (2) aid to communities that helps them overcome the spatial costs inherent in areas with a low population density, (3) the enforcement of civil rights and labor laws that help break down barriers to equal access by all citizens to the services of local societies, and (4) emphasize the need for grass roots participation in economic and social development. Second, farm programs need to help medium-sized farms. It is recommended that farm policy steer a course between the elimination of price-support programs and their continuation under present conditions. A rural development program for the South should not hinge on farm policy that preserves the smallest farms. Instead, a comprehensive development policy that improves employment opportunities and family income will offer off-farm jobs for the most marginal farms and their families. Since most of the small farms are presently dependent upon off-farm income, their current and future persistence depends upon a healthy nonfarm economy. The first priority for the nonmetropolitan South is a comprehensive rural development program.

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PUBLIC POLICY FOR FARM STRUCTURE AND RURAL WELL-BEING IN THE SOUTH

SECTION ONE: Introduction - Basic Information on The South

Introduction

This report deals with the enormous subject of farming and community well-being in the nonmetropolitan South, and, how these two highly complex and interrelated dimensions of southern life and work may be transformed by the advent of new agricultural technology. A detailed treatment of this subject is clearly beyond the scope of this report. Instead, we examine this subject in a general manner. For the most part unique characteristics of southern agriculture and rural community organization are not considered in great detail, nor are the many different subregions given special attention. Rather, the region is treated as a whole, focusing upon general indicators of technology, farming and community well-being.

A centerpiece of this report is the role of technology in societal change. The development and use of technology is generally and erroneously conceived of in a deterministic manner. That is, technology seems to develop independently of particular economic or social conditions and exerts an autonomous causal influence upon society. This is often the case for agricultural technologies. For instance, the popular notion that the mechanization of agriculture, particularly the "coming of tractors," caused U.S. farm numbers to decline and average farm size to increase. A more complex and substantively meaningful way of comprehending the role of technology as a force of economic and social change is as a tool that is a product of social and economic organization. This alternative approach, which would include such conceptual frameworks as the theory of induced innovation or the technological treadmill, requires that the social and economic conditions favoring the development and use of certain technologies be investigated. While this report has among its principal foci the influence of new technologies upon farm structure, and, in turn, the association of subsequent changes in farm structure with community well-being, technology is considered only to have an indirect association with community well-being. As a consequence, we will treat the role of technology apart from our discussion of farm and rural community change.

Our primary focus is upon farm change and community well-being in the nonmetropolitan South. Despite the nonmetropolitan South's immense diversity and the inherent difficulty of giving each aspect its proper due, the rewards of a general overview remain substantial. In particular, the South's agricultural sector offers a storied, and at times villanous, history of social organization and change. Investigation of this past demands careful attention to the myriad economic, social, and political forces that have shaped the options and molded the opportunities of millions of individuals and thereby helped create current conditions. Consequently, the articulation of the relationship of technology to various socioeconomic conditions, government policies, and the ways in which they act upon one another, is critical for both interpreting the past and making educated guesses about the future. We offer a condensed version of our understanding of these complicated relationships relative to the experiences of the South.

Historically, the South's rural areas have been on the periphery of national social and economic change. The labor force has a long tradition of being relatively unskilled and highly segmented by class, sex, and, of course, race. This tradition of uneven development persists to this day, and will have a marked influence upon the nonmetropolitan South's future. Such an unenviable position within the national economy and society has contributed to the lower standards of livelihood among southern rural people. The legacy of poverty is evident in the stereotypes of southern tenancy and corporate paternalism. Unfortunately, it is also responsible for more pejorative descriptions of the rural South as a culture of poverty. Such inaccurate but popular stereotypes blame the victims of this peripheral regional development.

In the recent past, the South has served as a great source of unskilled labor for the burgeoning manufacturing industries of the northeast and midwest. There were few incentives for many of the most able southern youth to stay at home on the farms, in the textile mills, or in the Applachain coal fields. There were many reasons for young blacks to escape the invisible dependency shackles of postbellum sharecropping. However, in recent years employment opportunities in the now called rust-belt have dwindled, and so too have the old migration streams northward.

The organization of work on southern farms has changed with the increased reliance upon labor- and land-saving technologies. Moreover, service and manufacturing industries have expanded their operations to include the once isolated southern rural communities. In fact, over the past century the economy of the rural South has become increasingly dependent upon changes in the nonfarm economy, thus possibly reducing the effects of further farm change for rural communities. Furthermore, the opening of nonfarm employment opportunities has provided an option for nonfarm income to supplement sagging farm incomes. The emergence of part-time farming appears to have had a major influence on the persistence of relatively small scale family farm operations in the South. Whether or not changes in farming and the penetration of nonfarm industries into the rural South are a source of hope or a new form of exploitation is a primary concern of this report.

Organization of the Report

The organization of a report like this involves compromises and a certain amount of disjointedness. The scheme settled upon here is intended to reduce conceptual confusion while presenting a hefty amount of data. Unfortunately, the reader may still find some of the transitions between sections a bit rough. We hope you will bare with us.

The report is divided into seven sections. We begin on the assumption that the reader is unlikely to be familiar with present conditions in the nonmetropolitan South. Therefore, the last part of this section provides information on current farm structure and community well-being in the nonmetropolitan South relative to the rest of the U.S. Once having described the current situation in the South, we return to a central theme of the report by providing the reader with our understanding of how technology, government policies, the national and farm economy, and the organization of farms are interrelated with one another in changing the character of southern agriculture. This discussion is presented in the second section. It also will provide the reader with a clear understanding of our biases in interpreting the results of the models presented.

The third section has two themes. The first is the placement of current conditions within a historical framework. Too often reports that make estimates of future change, such as this one, ignore the precedents and insights of the past. The agrarian history of the South is fascinating. It is a saga of slavery, yeoman farming, sharecropping, and large-scale industrial farms. The legacies of times past still influence the present and are likely to shadow the future. Our overview is all too brief. However, if this review is of interest there are numerous books that can fill in the conceptual and factual gaps (e.g., Daniel, 1985; Genovese, 1966; Hahn, 1982). The second theme examines the ways in which academia has examined farm and community change. Particular emphasis is given to the work of Walter Goldschmidt and current critiques of his classic study of Arvin and Dinuba, California.

Having laid out the conceptual and historical framework for understanding current conditions the fourth section begins by briefly reviewing empirical findings from farm structural models discussed at length in Appendix C. This background sets the stage for a more detailed description of emerging agricultural technologies among the primary commodities produced in the South.

The fifth section presents the research methodology, conceptual models, and statistical results of our empirical work that estimates the association of indicators of farm structure with community well-being, while controlling for measures of the nonfarm economy. Three measures of county well-being are investigated: median family income, the percent of families below poverty, and the percent of the work force that is unemployed. Two cross-sectional models are examined, one for 1970 and the other for 1980. Following the statistical procedures for panel analysis we assess the association of changes in various dimensions of farm structure with change in community well-being. These empirical models were designed to test the general assumptions of the Goldschmidt study.

The sixth section analyzes the significance of these empirical results along with other sources of information in order to make estimates of how further changes in farming, especially the simultaneous trends toward larger farms and part-time farming, will influence community well-being. Moreover, given the strength of association of nonfarm industries with the three measures of farm well-being we also examine how further changes in the nonfarm economy are likely to affect future rural quality of life.

The conclusions of the study are presented in the seventh section. It is here we make tentative recommendations involving both rural development policy and farm policy.

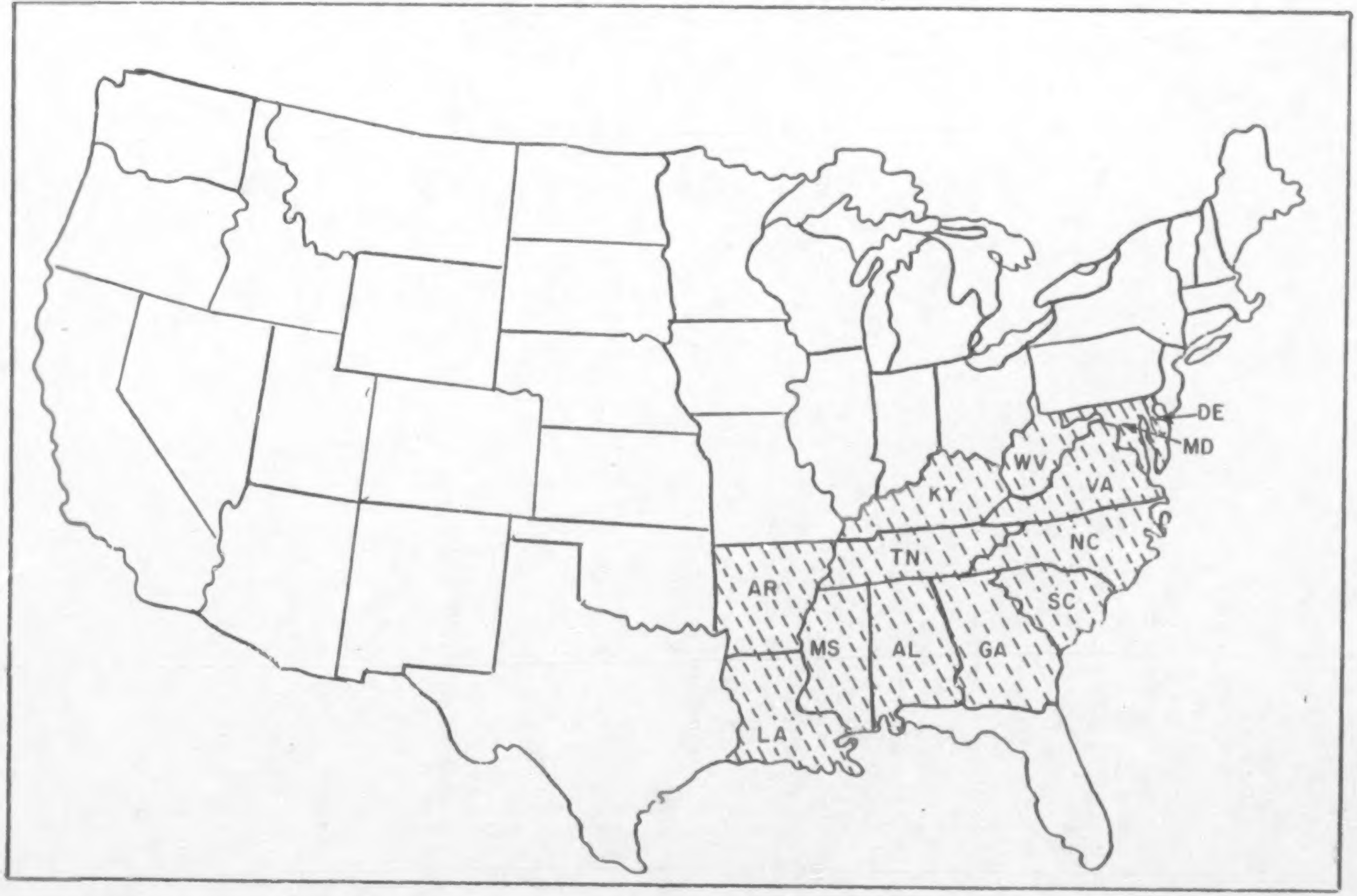
Basic characteristics of southern farms and rural communities

The South is an extremely interesting region for this study. Although the South has not been immune to national trends toward larger and fewer, there are distinct differences. Farms with low volume sales are concentrated in the South. (For this study the South includes: Alabama, Arkansas, Delaware, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia - see Figure 1.1.) In fact, roughly 35 percent of the nation's farms with sales under $10000 are located in the South. And while the South has roughly 27 percent of the nation's 2.24 million farms (1982 Census of Agriculture), only 17 percent of the nation's agricultural output comes from the South. Roughly 63 percent of the southern farms had sales less than $10000 in 1982. By comparison, only 44 percent of the farms in the rest of the United States (all figures referred to as the rest of the U.S. include the remaining 35 states in the contiguous 48 states) had sales of less than $10000 in 1982. By far the largest concentration of small farms in the South is in the Appalachian states (Virginia, West Virginia, North Carolina, Kentucky, and Tennessee).

In recent years the South has undergone change at a faster rate than the rest of the U.S. Farms have declined in number and increased in size faster, the rate of decline of full owners of farms has been greater, dependence in off farm work has increased at a faster rate, and increased dependence on hired labor has been greater in Souther states.

The South is also strikingly different from other sections of the country when aggregate measures of the quality of life for rural communities are examined. A greater percentage of families below the poverty level, lower median family income, and a greater unemployment level are all characteristics of the South versus the rest of the U.S. Yet, the South has a larger percentage of it's rural population employed in manufacturing industries.

Figure 1.1 States Included in the South for this Study


DE
MD
WV
VA
KY
NC
TN
AR
SC
MS
AL
GA
LA

Measures for farm size

When discussing the structure of agriculture most studies examine some measure of size of farm and then examine trends in order to evaluate farm expansion over time. The most common measure of size is dollar volume of agricultural products sold. Although there are problems with this measure, it is preferred to the use of acres per farm. Acres per farm is not a good measure of size since highly concentrated livestock or fruit and vegetables enterprises can exist on a very small acreage. This is especially true in the South where poultry is an important enterprise. Volume of sales suffers as a measure of size when one attempts to examine changes over time. Inflation distorts sales figures when comparisons are made between different points in time. The current Census definition of a farm uses $1000 of agricultural sales as a cut off point. Inflation from one Census to the next can result in inclusion of farms that may have never been classified as farms and may not have changed the amount of agricultural activity. Farms can also move from one sales class to the next under the same circumstances. For these reasons, this analysis will examine both measures of size (acres and sales) in order to more clearly assess changes in farm numbers and size over time.

Comparing farm structure in the South to the rest of the U.S.

It has already been established that the South has relatively more small farms than the rest of the U.S. Table 1.1 provides further information. Farms with sales of less than $40,000 makeup 82.3 percent of the farms in the South and 67.7 percent of the farms in the rest of the U.S. In order to place this size in perspective, a dairy farm with 22 cows averaging 15,000 pounds of milk per year and valued at $12 per hundred weight would sale $39,600. A corn farmer with 150 acres of corn yielding 100 bushels per acre would only need $2.67 per bushel to sale $40,000 worth of corn. Further, $40,000 worth of sales will yield less the $20,000 in income for nearly all farms. Thus, any farm with sales of less than $40,000 can be considered a small farm. Farms in the mid-size range ($40,000-100,000 in sales) account for 8.3 percent of the farms in the South and 17.3 percent of the farms in the rest of the U.S. The group with the largest sales (those with sales greater than $100,000) account of 9.3 percent of the farms in the South and 15.1 percent of other U.S. farms.

Similar differences exist between the South and the rest of the U.S. when acres in used as the measure of size. Farms with less than 180 acres makeup 73.2 percent of the total number in the South and 55.4 percent of the total number in the rest of the U.S. Farms with 180-999 acres account for 23.9 percent of the South's total and 35.8% of the total in the rest of the U.S. Finally farms of 1000 acres and greater comprise 3 percent of the South's total and 8.8 percent of the total in the rest of the U.S.

Table 1.1 - Comparing farm size concentration in the South to the rest of the U.S. - 1982 Census of Agriculture.

---- Farm numbers by sales class ----

Sales class	Total U.S.	South	Rest of U.S.
$250000 or more	86776	18142 (3.0%)*	68637 (4.2%)
100000-249999	216188	38089 (6.3%)	178099 (10.9%)
40000-99999	333047	49913 (8.3%)	283134 (17.3%)
20000-39999	249063	48903 (8.1%)	200160 (12.2%)
10000-19999	259258	67679 (11.2%)	191579 (11.7%)
less than 10000	1096792	379661 (63.0%)	717131 (43.8%)

----- Farm numbers by acres class -----

Acres class	Total U.S.	South	Rest of U.S.
1-9 acres	187699	50521 (8.4%)	137178 (8.4%)
10-49	449301	157060 (26.1%)	292241 (17.8%)
50-179	711701	233310 (38.7%)	478391 (29.2%)
180-499	526566	111163 (18.5%)	415403 (25.3%)
500-999	203936	32262 (5.4%)	171674 (10.5%)
1000-1999	97396	12983 (2.2%)	84413 (5.2%)
2000 or more	64525	5088 (0.8%)	59437 (3.6%)

*Percentages are proportion of total represented by each class.

Differences in the farm structure in the South versus the rest of the U.S. are further revealed when examining sales figures (see Table 1.2). Although farms with sales greater than $250,000 account for only 3 percent of the farms in the South, these farms contribute 43 percent of the total agricultural sales in the South. These same sales class accounts for 4.2 percent of the farms in the rest of the U.S. and contribute 48.5 percent of the total sales. If only farms with sales greater than $40,000 are considered, these farms contribute 84.3 percent of the total sales in the South and 90 percent of the total sales in the rest of the U.S.

Table 1.2 - Comparing sales accounted for by each sales class - 1982 Census of Agriculture.

Sales class	Total U.S.	South	Rest of U.S.
		-- Values are in $100000 --	
$500000 or more	$42764	5157 (23.1%)*	37607 (34.4%)
250000-499999	19851	4441 (19.9%)	19851 (14.1%)
200000-249999	7829	1634 (7.3%)	6195 (5.7%)
100000-199999	25101	4358 (19.5%)	20743 (19.0%)
60000-99999	14352	2116 (9.5%)	12236 (11.2%)
40000-59999	7289	1113 (5.0%)	6176 (5.7%)
20000-39999	7142	1377 (6.2%)	5765 (5.3%)
10000-19999	3694	952 (4.3%)	2742 (2.5%)
less than 10000	3566	1202 (5.4%)	2364 (2.2%)

*Percentages represent the total sales accounted for by each sales class. For example, farms with greater than $500,000 in sales account for 23.1% of the total farm sales in the South and 34.4% of the total farm sales in the rest of the nation.

The South is also undergoing change at a faster rate than the rest of the U.S. Comparing the 1969 and 1978 Census of Agriculture, farm numbers declined faster in the South than the rest of the U.S. Table 1.3 shows similar farm numbers per county in 1969 and a rate of decline in the South nearly double that of the rest of the U.S. (Recall that all dollar figures in Table 1.3 are in 1982 values.) Examining farm size gives further evidence of these trends. The rate of increase in the South (whether size is measured by sales or acres) was greater than in the rest of the U.S. (in fact, per farm acreage decline in the rest of the U.S.). County average figures in Table 1.3 also illustrate the difference in average farm size in the South versus the rest of the U.S. Average farm size (as measured by sales) is 70 percent greater for the rest of the U.S. As is evident throughout this study, small farmers depend upon off-farm work. This dependence is further revealed by comparing the dependence in the South versus the rest of the U.S. In 1978, 47.3 percent of the farm operators worked off-the-farm 99 days or more in the South as compared to 38.2 percent in the rest of the U.S. It is significant that farm size and numbers were declining at a faster rate in the South than the rest of the U.S. and there was still a greater increase in dependence in off-farm-work in the South.

Table 1.3 - Comparing Basic Farm Structure Statistics in Nonmetropolitan Counties

Variable	Rest of U.S.	--- South ---	
	county mean	county mean	standard dev.
Farm Numbers	860*	849	617
	741	624	455
	(-117)	(-226)	(214)
Farm size (sales)	$48788	$24675	19605
	77140	46112	39492
	(28510)	(21357)	(23002)
Farm size (acres)	1232	205	116
	1220	232	136
	(-8.6)	(37.1)	(64)
Part-time farming	36.1%	44.3	10.5
	38.2	47.4	10.5
	(2.0)	(3.1)	(5.8)
Chemical & fert. use /farm	$2697	$2646	2994
	5713	5517	6526
	(3032)	(2872)	(3782)
Machinery value / farm	$27584	$17023	11868
	54710	36043	27190
	(27227)	(19008)	(16261)

Table - 1.3 (cont) Comparing Basic Farm Structure Statistics

Variable	Rest of U.S.	South	
	County mean	County mean	Standard dev.
Hired labor / farm	$4781	$3049	4023
	4638	3936	4386
	(-142)	(884)	(1690)
Farms below 180 acres	43.4%	71.0%	13.2
	43.5	67.2	13.5
	(.1)	(-3.8)	(5.4)
% full owners	55.8%	70.6%	14.8
	38.9	38.0	10.0
	(-16.9)	(-32.6)	(13.1)
% tenant operators	13.9%	9.9%	8.4
	11.9	8.0	7.2
	(-2.0)	(-1.9)	(3.6)
% grain sales	18.4%	11.0%	16.2
	25.9	20.0	22.2
	(6.6)	(9.0)	(9.6)
% livestock sales	38.0%*	17.7%	12.4
	36.9	20.6	17.5
	(-1.4)	(3.1)	(10.5)

*1967-1970 values are listed first.
1977-1980 values are listed second.
The change between the two time periods appear in parentheses.

Since farms are larger in the rest of the U.S., it is only logical that per farm expenditures on inputs would be greater in the rest of the U.S. Table 1.3 reveals that per farm expenditure on chemical and fertilizer and hired and contract labor are greater for the rest of the U.S. These differences are not as great as the differences in machinery value per farm (in 1978 machinery investment per farm was $34,773 in the South and $54,710 in the rest of the U.S.). Rates of change in chemical and fertilizer and machinery use were similar in the South and the rest of the U.S. The large increase in machinery investment was clearly a national trend in response to both improved agricultural prices and technological innovations in machinery.

One of the more dramatic changes in the structure of agriculture in the South involves the percent of full owners. The rate of decline was twice has great in the South (the South went from 70.6 percent full ownership in 1969 to 38.5% in 1978). The rate of change in percent of tenant operators was the same in the South and the rest of the U.S.

The concentration of grain sales within a county increased throughout the U.S. This increase was a result of market forces as the increased grain sales in international markets improved the price of grain relative to other farm alternatives. The rate of increase was greater in the South - the difference between the two points in time was 6.6 in the U.S. and 9.0 in the South.

Further evidence of the dependence on off-farm work is supplied in Table 1.4. The South continues to rely more on off-farm work than the rest of the U.S. Operators who work off-the-farm makeup 53 percent of the farms in the South and 45 percent of the farms in the rest of the U.S. Table 1.4 also breaksdown off-farm work by sales class in the South. Since small farms depend upon off-farm work to supplement farm income, these farms should have a greater proportion of off-farm work than larger farms.

Table 1.4 - Days of operator work off-the-farm by sales classification - 1982 Census of Agriculture.

Sales	No days	1-99 days	100-199 days	200 or more	Any days (% only)
$500000 or more	3486	380 (8.5%)*	159 (3.6%)	453 (10.1%)	(22.2%)
250000-499999	8529	1110 (9.6%)	475 (4.1%)	1395 (12.1%)	(25.8%)
100000-249999	22684	3647 (11.1%)	1738 (5.3%)	4704 (14.4%)	(30.8%)
40000-99999	26596	6026 (13.8%)	3195 (7.3%)	7856 (18.0%)	(39.1%)
20000-39999	20341	5638 (12.9%)	4417 (10.1%)	13213 (30.3%)	(53.3%)
10000-19999	22897	6717 (11.2%)	6557 (10.9%)	24059 (39.9%)	(62.0%)
less than 10000	100134	28991 (8.3%)	36092 (10.3%)	185790 (52.9%)	(75.3%)
Totals	204667 (37.4%)	52509 (9.6%)	52633 (9.6%)	237470 (43.4%)	(62.5%)
Rest of U.S.	657131 (43.8%)	171224 (11.4%)	136164 (9.1%)	537374 (35.8%)	(56.3%)

*Percentages represent the proportion within each sales class. Calculations are made based on those responding to this question.

Changes in farm numbers in the South are displayed in Table 1.5. Farm numbers decline 8.5 percent from 1974 to 1982. Further, changes in the South are similar to the national trend - growth in number of farms is occurring in the smallest and largest sales classes. Farms in the 1-9 acre class increase 20 percent in the South. Much of the increase can probably be attributed to inflation. The largest rate of decline is for farms with between 50 and 260 acres. Changes in farm numbers by sales class are also reported in Table 1.5. These rates of change are not informative since inflation accounts for the bulk of these changes.

Table 1.5 - Comparing farm numbers in the South by two size classes - acres and sales.

		-----Acres classification-----		% change
acres	1974	1978	1982	1974-82
1-9	42125	70330	50521	+20%
10-49	156158	176569	157060	+ 0.6
50-69	67442	65947	58342	-15.6
70-99	81823	77902	66617	-22.8
100-139	79274	77478	65568	-20.9
140-179	51769	50928	42783	-21.0
180-218	35870	35121	30503	-17.6
220-259	25346	24920	21477	-18.0
260-499	64506	65769	59183	- 9.0
500-999	31849	34311	32262	+ 1.3
1000-1999	12655	13134	12983	+ 2.6
over 2000	5029	5106	5088	+ 1.2
Totals -	653846	697595	602387	- 8.5

		------Sales classification------		
Sales $100000 or more	31332 (4.8%)*	46137 (6.6%)	56231 (9.3%)	+79.5
40000 to 99999	51678 (7.9%)	56548 (8.1%)	49913 (8.3%)	- 3.5
20000 to 39999	50805 (7.8%)	56177 (8.1%)	48903 (8.1%)	- 3.9
10000 to 19999	68398 (10.5%)	77761 (11.2%)	67679 (11.2%)	- 1.1
less than 10000	451215 (69.1%)	460566 (66.1%)	379661 (63.0%)	-18.8

*Figures in parentheses represent the percent of total sales accounted for by that particular sales class.

Dominate Farm Enterprises in the South

Six farm enterprises contribute 77.5 percent of the farm sales in the South (poultry and eggs, cash grain, tobacco, dairy, beef -except feedlots- and cotton). Using the 1982 Census of Agriculture's Standard Industrial Classifications (farms with sales of 50% or more in a specific classification fall into that class) these six classifications account for 78 percent of the farm numbers in the South. Table 1.6 demonstrates the degree of concentration that exist in these six SICs. Poultry and eggs is clearly the most concentrated with 62.6 percent of the farms in this class having sales of $100,000 or more. Further, poultry and eggs account for nearly a quarter of the total agricultural sales in the South while only comprising 4 percent of the farm numbers. At the other extreme, 86 percent of the beef farms in the South have sales of less than $10,000. Although beef farms makeup 33 percent of the total farm numbers in the South, they only contribute 6.3 percent of the farm sales. Dairy and cotton farms are relatively concentrated with roughly 42 percent of the farmers in these classes having sales of greater than $100,000. Tobacco farms are predominantly small farms. While grain farms in the South are also dominated by relatively small farms.

Table 1.6 - Top six SIC farms by sales classification

Sales	Poultry & eggs	Cash grain	Tobacco	Dairy	Beef	Cotton
more than 500000	1705	918	131	339	102	518
250000-499999	4125	2988	580	1563	217	947
100000-249999	9473	9016	4417	5992	1041	1604
40000- 99999	5135	13597	10504	5958	3331	1527
20000- 39999	1581	12091	13960	2745	7008	971
10000- 19999	659	13247	21028	1414	16455	903
less than 10000	1824	43790	72957	883	171912	1429
Total	24602	95647	123577	18894	200066	7381
% with sales greater than 100000	62.6%	13.5	4.1	41.8	.7	41.6
% with sales less than 10000	7.4%	45.8	59.0	4.7	85.9	19.0
% of total sales in the South	24.4%	21.0	11.6	9.0	6.3	5.2
% of total farms in the South	4.1%	15.9	20.5	3.1	33.2	1.2

These six Standard Industrial Classifications account for 78% of the total farms in the South and 77.5% of the total farm sales. By comparison, they account for 64% of the total U.S. farm sales.

Of the six farm enterprises that dominate the South, Table 1.7 shows that the South produces 93.4 percent of all of the tobacco sold in the U.S. and 54.2 percent of the poultry and eggs. The South also produces a relatively large share of the cotton (37 percent of total sales). Since the South produces 17 percent of the total sales in the U.S., the other SICs (cash grain, dairy, and beef) account for a relatively small proportion of total sales in the U.S.

Table 1.7 also provides information on how these top six SIC's contribute to each of the 13 southern state's agricultural sales. Although there is a good deal of diversity regarding the mix of these six enterprise between states, in total, these six enterprises account for a large share of each of the states total sales (a high of 94 percent in Arkansas and a low of 64 percent in Georgia).

Table 1.7 - Top six SIC's by percent of each state's total sales

	Poultry & eggs	Cash grain	Tobacco	Dairy	Beef	Cotton	Percent of total
Alabama	41%	13	0	5	10	7	76
Arkansas	37	43	0	4	6	4	94
Delaware	63	16	0	5	0	0	84
Georgia	35	12	5	7	4	1	64
Kentucky	1	21	29	13	8	0	72
Louisiana	10	40	0	10	6	16	82
Maryland	37	17	4	23	1	0	82
Mississippi	21	28	0	7	8	28	92
N. Carolina	26	9	33	1	2	0	71
S. Carolina	17	21	21	9	4	4	76
Tennessee	6	25	12	19	11	5	78
Virginia	19	11	12	19	11	0	72
W. Virginia	23	4	2	21	25	0	75
% of total sales in the South	24.4%	21.0	11.6	9.0	6.3	5.2	77.5
% of total sales of each SIC in the U.S. (% produced in the South)	54.2%	13.9	93.4	11.1	8.6	36.9	NA

Table 1.8 provides further information on the differences between states in the South. For the most part these statistics are self-explanatory. The fact that Delaware has an average farm size of $111,010 in farm sales can be tied to the concentration of poultry and eggs in that state. Likewise, the small average farm size in West Virginia is due to the dominance of beef. The three top states in terms of farm numbers are also major tobacco producing states.

Table 1.8 - Farm characteristics by State.

State	Farm Numbers	(rank)	Value of Agr. Products sold ($1000)	(rank)	Average farm size(by sales)
Alabama	48448	(7)	$1704160	(6)	$35180
Arkansas	50525	(15)	2826497	(2)	55940
Delaware	3338	(13)	370562	(12)	111010
Georgia	49630	(6)	2767679	(3)	55770
Kentucky	101642	(1)	2376882	(4)	23380
Louisiana	31628	(9)	1406458	(9)	44470
Maryland	16183	(12)	1029244	(10)	63600
Mississippi	42415	(8)	1918486	(5)	45230
N. Carolina	72792	(3)	3500750	(1)	48090
S. Carolina	24929	(10)	968554	(11)	38850
Tennessee	90565	(2)	1683852	(7)	18590
Virginia	51859	(4)	1606915	(8)	30990
W. Virginia	18742	(11)	242127	(13)	12920
South totals	602696		22402166		
U.S. totals	2241124		131810903		
South as a proportion of the total U.S.	26.9% of the total farms		17.0% of the total sales		

Quality of life variables in the South versus the rest of the U.S.

Table 1.9 provides comparison of certain nonmetropolitan county quality of life variables. Among the more striking comparisons is the percent of families below poverty. Poverty in the South was greater than in the rest of the U.S. in both 1970 and 1980. In 1980, the average non- metropolitan county poverty level was approximately 6 percent higher in the South than in the rest of the U.S. Average median family income values are consistent with the poverty measures. Family income in the South is lower than the rest of the U.S. in both 1970 and 1980. These inflation adjusted numbers also reveal the general economic growth that occurred in the South in the 1970's (i.e., there was a larger increase in family income in the South between 1970 and 1980). The South's willingness and ability to tax property are also apparent from Table 1.9. Property taxes per capita (adjusted for inflation) are considerably higher in the rest of the U.S. Unemployment numbers are slightly higher in the South and the incidence of southern unemployment appears to have increased faster in the 1970's. The proportion of farm to rural population is considerably higher in the rest of the U.S. than in the South. This suggest that southern nonmetropolitan counties are also less dependent on farm population than similar counties in the rest of the U.S. Employment in manufacturing is notably higher in the South. Finally, employment in service industries has grown in the rest of the U.S. at a faster rate than in the South.

Table 1.9 -Quality of Life Variables in Nonmetropolitan Counties

Variable	Rest of U.S.	---- South ----	
	County mean	County mean	Standard deviation
County Pop	21738*	23036	18377
	25064	26723	21960
	(3331)	(3688)	(4505)
% families below poverty	15.0%	26.6%	9.7
	11.8	17.6	6.5
	(-3.2)	(-9.0)	(4.9)
Total year housing units	7550	7500	5799
	9840	9907	7975
	(2293)	(2406)	(2455)
Property Taxes per capita	$346	$103	44
	396	135	66
	(50)	(31)	(49)
Retail Establishments	247	226	177
	248	237	197
	(1)	(10)	(45.5)

Table 1.9 - (Cont) Quality of Life Variables in Nonmetropolitan Counties

Variable	Rest of U.S.	---- South ----	
	County mean	County mean	Standard deviation
Median Family Income	$17547	$14055	2971
	20860	18112	3120
	(3312)	(4057)	(1642)
% Unemployment	4.53%	4.93%	2.3
	6.5	7.8	2.7
	(2.0)	(2.9)	(2.3)
Farm / rural population	27.1%	17.5%	12.3
	18.8	9.1	6.8
	(-8.3)	(-8.4)	(6.9)
% employed in manufacturing	16.0%	30.4%	12.2
	15.8	29.3	11.4
	(-.2)	(-1.1)	(4.9)
% employed in services	7.0%	7.7%	2.8
	18.9	16.8	4.5
	(11.9)	(9.1)	(4.7)

*1967-1970 values are listed first.
1977-1980 values are listed second.
The change between the two time periods appear in parentheses.

Conclusions

The basic information provided in this section serves as a backdrop for sections that follow. How can economic and sociological theory help in explaining the current structure of agriculture in the South? This question is addressed in the next section. What particular aspects of the historical development of the South offer an explanation for why the South is different than the rest of the U.S.? Section three addresses these issues.

Small farms dominate the South. Yet, in certain commodities, the South has farms that are as large as any in the U.S. - particularly in the poultry industry. Clearly, there is great diversity in farm types in the South. While 63 percent of the poultry farms in the South have sales of $100,000 or more, 86 percent of the beef farms have sales of less than $10,000. These diverse farms are located in a region that has a long history of relative rural poverty. This combination of characteristics does indeed make the South an interesting region to examine the relationship between farm structure and rural well-being.

SECTION 2

Examining Forces that Contribute to Farm Structural Change

The current structure of U.S. farms is the product of a complex interaction between a variety of economic, political, and social forces. Depending upon particular localities and points in time, these forces have been influential for more that a century, with some having more influence under particular historical circumstances. The simple model in Figure 2.1 illustrates the interactive system among policy - technology - economies of size - farm structure - and resource mix. Farms expand in size for a variety of reasons. Farm expansion in the aggregate will naturally lead to larger and fewer farms. Since this analysis is primarily concerned with technology, the discussion below centers on technology.

Adoption of Farm Technologies

The development and introduction of farm production technologies have often been considered as an independent cause of farm structural change. This oversimplification of the role of technology is most often referred to as "technological determinism" (c.f., Rosenberg, 1982). While technological changes clearly have been associated with farm structural changes, it is equally clear that the mere existence of new technologies neither assures their adoption nor their influence on farm structure. It is not the development of technologies that drive farmers to maximize their profits, but it is the need to maximize their profits that induces farmers to adopt technology in order to remain competitive. Consequently, while technology has facilitated considerable changes in farming, the adoption of production technologies by farmers is the result of complex economic, social, and political factors. This section briefly examines how these factors have contributed to the utilization of technology by farmers and is the basis of later assumptions about the future influence of technology on farm change.

It is quite likely that even without substantial changes in the labor-, land-, and capital-saving technologies that the competitive market structure still would have produced a highly concentrated farm sector. The persistence of a farm operation is dependent upon its successful participation in a competitive market. However, the low return to capital and labor invested in farm production has made it exceedingly difficult for most farmers to compete successfully. A primary reason for these historically low returns to farm investments has been an overallocation of resources to farming. Thus, there has been a tendency for farmers to produce more than the market can bear. That is, farms tend to overproduce for markets characterized by inelastic demand.

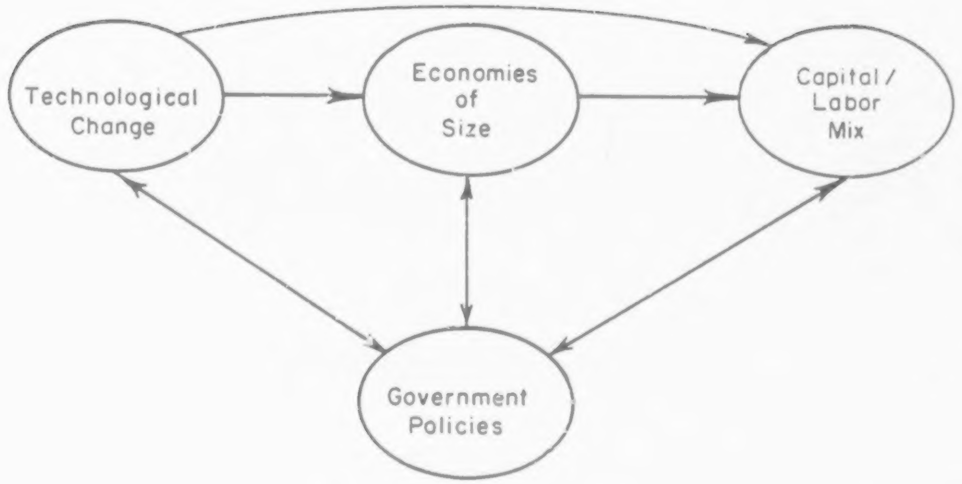

Technological Change
Economies of Size
Capital / Labor Mix
Government Policies

Fig. 2.1 A Simple System of the Relationship Between Policy, Technology, and Farm Structure.

One way farmers have reacted to these generally unfavorable production conditions is to expand the scale of their farm operations. While such a decision appears to be rational at the individual farm level as declining profit margins make it necessary to expand in order to increase farm income, at the aggregate level such expansion contributes once again to overproduction. Since land is relatively fixed and domestic and international demand is unlikely to keep pace with technologically induced supply, those farmers who are unable to expand their scale often leave production entirely or else enter into part-time farming. Expansion of farm scale without the introduction of production technologies could have occurred with greater inputs of hired labor, which occurred in some manufacturing sectors. However, the scarcity of labor and land created a demand for the development of technologies to extend the productivity of limited resources, and both private and public research and development efforts have responded with an impressive array of resource-saving agricultural technologies. Ruttan's (1982) articulation of induced innovations provides a more detailed discussion of this process.

Technological changes have increased productivity in the production of food. What does this mean? Increases in productivity enable farmers to change resource mixes in such a fashion that they can produce more output per unit of input (or cost). Thus, since agriculture is a relatively competitive industry, profit margins per unit of output decline, and farmers are forced to expand in output (by increasing farm size) in order to receive the same income. Technology that is labor saving, land saving, and capital using has been responsible for these changes in productivity. Machinery has reduced the amount of labor necessary in many farming operations enabling one worker to farm more land or manage more livestock. Chemicals, plant breeding, and other biological technologies have increased the amount of crops or livestock that can be obtained from an acre of land. Thus, technological change has increased economies of size - per unit costs of production decline as farm size increases.

Technological innovations provided an impetus for farm expansion. Yet, other factors had to be in place in order for this expansion to occur. Adoption of new technologies only occurs if a variety of institutions are in place. Since investments in new technologies require large amounts of capital, readily available credit is necessary before farmers will adopt new technologies. Without the passage of the Federal Land Bank Act of 1916, agricultural credit would not have been as accessible, and the technological revolution in U.S. agriculture would have been slowed considerably. Since many of the new technologies of the twentieth century replaced labor, job opportunities in nonfarm activities were needed before much of the transformation in U.S. agriculture could occur. In areas of the country where off-farm job opportunities were not available, adjustments were slowed. Such is the case for much of the Appalachian region where small farms are still dominant. Although farmers in this region receive a low labor income from farming, they have relatively few off-farm activities that will give them a higher wage. Even those farmers who find off-farm employment in this region generally continue to depend upon a limited farm income.

In addition to credit policies and rural development, other government activities influence technological adoption. Adoption of many technologies necessarily means a change in the capital/labor mix. Therefore, any government policy that influences the relative costs of these inputs will also influence technological adoption. For example, federal tax laws provide a number of incentives to invest in capital-intensive technologies. Investment tax credits, rapid depreciation, interest write-offs for borrowed money, etc., all reduce the after-tax cost of capital. On the other hand, employers are required to pay Social Security taxes for hired labor. In addition, there are other government regulations regarding hired labor. These laws increase the relative cost of labor to capital and, thus, encourage adoption of labor-saving technologies and influence the capital/labor ratio in U.S. agriculture.

There are other reasons why farmers choose capital investments over labor. Labor may be more difficult to manage than capital. Labor may be less dependable than capital. Since much farm work is seasonal, farmers may not be able to assure a hired laborer of full time work. Thus, it is difficult to maintain continuity in hired labor. Training new employees is costly. In addition, timeliness of planting and harvest can be improved with capital. This means that risk of production can be reduced with capital investments.

Another factor that influences adoption of machinery technology is the topography of a region. Many of the large machines used in modern agriculture are unsuitable for the very hilly areas in the Appalachian states (Virginia, West Virginia, North Carolina, Kentucky, and Tennessee) and parts of the Piedmont areas of the Carolinas. These regions have a large concentration of small farms. Clearly, the topography of these regions has constrained farm expansion through adoption of machinery technology.

Other barriers to the adoptions of certain types of agricultural technologies include the poor development of internal markets, particularly the absence of good roads to get produce to central markets. Furthermore, personal characteristics such as low education, a consequence of the slow social development of many areas of the rural South, reduced the readiness with which some farmers could take advantage of new information.

Cochrane's Technological Treadmill

The continuous technological changes in farming have been associated with changes in the farm labor processes and the ability of some farms to stay in production. Cochrane (1979:393) sums up this process for American farmers in terms of a "technological treadmill":

> We know now why farmers adopt new and improved technologies and expand their output even though they complain of low product prices and rising input prices. They do so (in part) because each farmer sees the adoption of a new and im-

> proved technology as a means of either increasing his profits or reducing his losses. But in a competitive situation, with many producers, there is no way that an individual farmer can hold onto himself the short-run gains from the adoption of new and improved technology. Such income gains are lost to him in the long run through the competitive process. They are lost in a free-market situation through falling product prices. They are lost in a price-supported situation through rising prices of the fixed factors - typically land.

Thus, with each new technology, those farmers who adopt earliest gain the most. Those farms most likely to respond first either have access to information or capital. These farms tend to be among the largest farms. Nonadoption or late adoption does not necessarily indicate a lack of innovation, but it is often a function of limited access to capital and information, relatively small scale, or any combination of these factors. Farm numbers in the United States have been reduced by roughly four million since the end of World War II. It is safe to say that many of these farmers did not leave farming because they were bad farmers, but because they did not have the resources necessary to stay on the technological treadmill.

Influence of Government Policies on the Supply and Demand of New Technology

Government polices also influence the development of technologies in very important ways. Besides the obvious involvement of government- supported research and development and education through the agricultural Extension service and the agricultural research complex, government policies influence the market or the demand for new technologies. When government policies provide incentives for the adoption of technologies (such as those discussed above), producers of technologies will have additional incentives. Patent laws that protect those who invent new technologies can encourage development of new technologies. Price supports that provide protection against low prices also reduce risk and encourage investment in new technologies. On the other hand, some government policies may hamper the production of technology. Price supports that are based upon cost of production or parity reduce the need to develop new technologies that will reduce cost of production. Also, price supports that rely on supply control in order to keep price high will hamper technological innovation. In other words, if the government supports profit margins at relatively constant returns per unit of output, incentives to reduce per unit cost of production will be reduced. Government supply control and price support policies in the tobacco sector are at least partially responsible for the fact that technological development has been slow (i.e., burley tobacco production remains a highly labor intensive activity).

Government Policies that Influence Farm Structure

There are also government policies that influence the structure of agriculture with little influence on technology. These political decisions have not been made in a soci-political vacuum. Rather, each of the many factions within agriculture campaign for their particular interests, which often are in conflict with other factions. The relative political power of each group mediates the degree to which final farm policies facilitate their interests. Furthermore, each succession of farm policies reflect the legacy of past attempts to reduce market uncertainty during previous periods of farm financial crisis.

The economic and political conflict over farm policies has been ubiquitous during the past century. Much of this conflict and compromise has centered upon the reduction of uncertainty and the enhancement of profits.

> Just as during the Progressive Era many industries called for order and advocated federal rules to rationalize enterprise, farmers by the end of the 1920s, after unsuccessful farm movements, cooperatives, and political lobbying, demanded that the federal government bring order to the chaos of rollercoaster prices that charted the peaks and valleys of supply and demand. The advocates of rural change reflected no more upon long-range human displacement than did the captains of industry; each wanted an efficient operation that depended more upon the regularity of machines and federal guidelines than on the whims of workers and the marketplace. (Daniel, 1985: xiii)

Perhaps the most influential among these policies were the farm programs embodied in the Agricultural Adjustment Acts of the New Deal. Among these programs, a principal policy mechanism for improving farm income was the control of overproduction through supply management.

Supply control policies that are used to increase price are usually designed in such a fashion that allotments are allocated to farmers that have been involved in the production of the particular good for a period of time. Thus, these allotments take on a monetary value that is usually reflected in land prices. Therefore, in addition to an artificially high price, farmers who own land will gain in wealth because of government action. This combination of factors can retard the exodus of small farms in some areas. On the other hand, when price supports are not tied to allotments, it can be argued that, over time, they contribute to the trend toward larger and fewer farms. To the extent that price supports are bid into asset values, they cause asset values to be overpriced for new farmers. Existing farmers use the current operation to finance purchases from exiting farmers. Thus, the trend toward larger and fewer farms is exacerbated. Also, price supports are tied to output. Therefore, larger farms receive more of the benefits than smaller farms. Yet, it can also be argued that, in the shorter run, commodity programs (price supports) slow the exodus of smaller farms that are inefficient. When prices are supported at levels that are higher than market conditions (i.e., both opportunity and real cost of production) will justify, then smaller farms are protected longer from those market conditions. Eventually, such protection must give way to the financial stress that accompanies the overvalued asset values (i.e., as producers leave farming, only those with existing assets can afford to cash flow the new purchase).

In the 1950s and 1960s, commodity programs provided a great deal of price stability. There is much disagreement regarding the implications of price stability on farm structure. Those who believe that stable prices contribute to the trend toward larger and fewer farms argue that reduced risk encourages capital investments and, thus, farm growth. Those who believe farms grow more during periods of price instability argue that farmers must seek tax shelters when they receive extraordinarily high prices. Therefore, they will purchase more land and machinery than they might if they had an equal but steady long-run average income. In addition, price instability increases financial risk. As financial risk increases, odds of farm failure increase. As farms fail, existing farms are the most likely candidates to purchase them. Roughly two-thirds of the agricultural land that is sold in the U.S. is purchased by existing farmers. The current financial problems in U.S. agriculture are largely due to false price expectations on both agricultural commodities and assets that were developed during the 1970s. Farms that expanded rapidly during this period are now struggling to survive. Larger farming operations that are currently not experiencing debt problems will be the dominant beneficiaries as these farms fail. Knowledge of debt load by farm size is critical to understanding the implications of the current financial problems on future agricultural structure.

In addition to the direct government involvement in commodity programs and credit assistance programs, many macroeconomic policies influence the structure of U.S. agriculture. Tax policies have encouraged farm expansion beyond levels that a market system would have. Monetary and fiscal policies have influenced the financial environment in which farmers operate. Macroeconomic policies of the 1970s, which were directed most toward reducing unemployment, led to low real cost of interest (i.e., the difference between interest rates and inflation rates), high rates of inflation, and low value of the dollar (which expanded international trade). Negative real rates of interest and high rates of asset inflation plus a growing export market contributed to the farm expansions that occurred in the 1970s. Macroeconomic policies of the 1980s which were directed most toward reducing inflation rates, led to high real cost of interest, lower inflation rates, and high value of the dollar. This interaction of market forces is largely responsible for the reductions in farm asset values, which have increased the cash flow and long term financial problems facing farmers. In short, once U.S. agriculture entered heavily into world trade in the early 1970s, the farming sector became extremely vulnerable to U.S. macroeconomic policy. Such policy may now be more critical to long run farm structure than traditional commodity and credit programs.

The Interaction Between Commodity Programs and Technological Advancements - Who Benefits from Technological Advancements?

In the absence of commodity programs, economic theory provides some insight into whether farmers or consumers will benefit from technological advancements. To the extent that the demand for a particular agricultural commodity is inelastic (i.e., small changes in output lead to greater changes in price), total revenue will be less when the supply curve shifts to the right due to technological advances. Therefore, if the change in total revenue is greater than the change in total cost (which occurs because of the technological change), then, in the aggregate, farmers will be harmed at the expenses of consumers. Such conditions would be more common than situations where the reduction in total costs is greater than the reduction in total revenue. Of course, farmers who are early adopters of the technology will benefit despite the fact that in the aggregate farmers would lose.

Figure 2.2a illustrates the influence of technology-induced supply shifts on the total revenue of producers in the absence of price supports. Before the supply shift, the total revenue is the area in the rectangle abco. After the supply shift, the total reverue is the area in the rectangle defo. Since the area dxco is contained in both sets of revenues and it is clear that the area abxd is less than cfex, then it is also clear that total revenue (area defo) after the supply shift is less than total revenue (area abco) before the supply shift.

Figure 2.2b considers the case where the government supports the price at a level that is higher than what a new market price would be after a technology-induced supply shift. The price support level is a political decision (the level for this illustration was arbitrarily chosen). In this case, the demand curve becomes perfectly elastic at the price support (i.e., government will purchase all that is produced at that price). Therefore, the total revenue is greater after the supply shift (by the same reasoning as presented above, the area cfex is greater than the area abxd). Although the likelihood that the government could sustain a price support at this level is questionable, it is clear that farmers will gain in two ways from the technology shift as long as government price supports remain above what would be a market clearing level (as presented in Figure 2.1a): (1) total revenue will increase; and (2) total cost will decrease. The competitive nature of the farming sector is such that this type of increase in net income will be bid into asset values (primarily land prices). Again, it can be argued that government programs would have to adjust. Yet, lags would likely be involved with this adjustment, and as long as the adjustment is not too severe, the next technologically induced shift in the supply curve will offset the adjustment. Therefore, farmers will very likely gain in the aggregate when technology-induced supply shifts occur for price-supported commodities. And landowners will gain even more since these gains are bid into asset values.

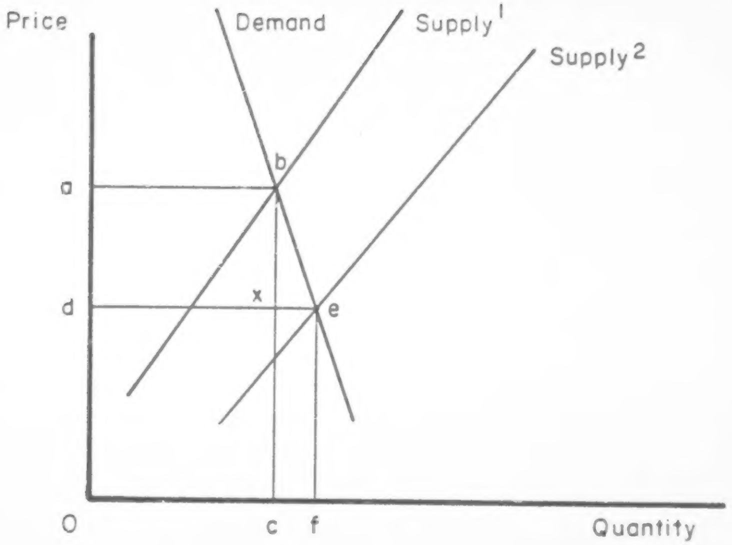


Fig. 2.2a Influence of Technology Induced Supply Shift on Total Revenue Without Price Support.

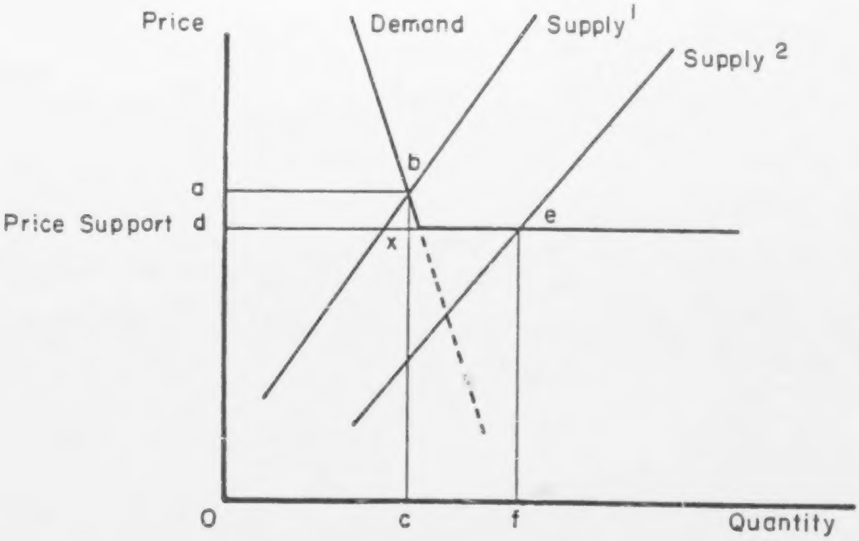


Fig. 2.2b Influence of Technology Induced Supply Shift on Total Revenue With Price Support.

These arguments are strengthened with further insight into likely government behavior to respond to the increase in supply. Historically, the government has been more likely to impose supply control programs rather than reduce the price support. Since most supply control programs involve some type of allotment system, such policy provides even greater gains to landowners.

The interaction between commodity programs and technological changes reinforces those who argue that government programs accelerate the trend toward larger and fewer farms over a longer period of time. Further, from a policy perspective, it provides evidence of how commodity programs have contributed to the current cash flow problems in U.S. farming, as these problems are due to the fact that asset values become overvalued in terms of what they can return. Such a cash flow problem increases the vulnerability of farmers who have used credit extensively for expansion. Therefore, although commodity programs may slow the exodus of some farmers (i.e., those unable to leverage assets and acquire additional debt), in the aggregate, commodity programs have facilitated the bimodal distribution by encouraging farmers with larger operations to expand and by providing profit margins suitable to maintain smaller farms that have off-farm income.

Southern Agriculture and Farm Policy

Each region of the U.S. has followed a different course of farm structural change, usually depending upon the types of commodities raised. In the South three commodities in particular have had a dominant role in shaping its configuration of farm structures: cotton, rice, and tobacco.

The cultural, farm structural, and technological changes in producing each of these commodities have been very different and the rate of change uneven. The different courses of change underscore the necessity of examining each commodity in terms of its unique characteristics. Daniel (1985) has compared the changes of each of these commodities.

> Each of these three cultures mechanized at a different rate. Rice growers in the prairie adapted binders and threshers in the 1880s, installed expensive irrigation networks by the 1890s, replaced mules with tractors during World War I, and turned to combines by 1945. Cotton farmers haltingly used tractors in the 1920s, increased their use greatly in the mid-1930s, and by the late 1940s invested in mechanical cotton pickers and chemical weed killers that ended the need for seasonal labor. Only in the 1970s did harvesting machines and bulk curing significantly cut labor requirements in the tobacco culture. Internal dynamics and tenure systems also varied. The rice culture, restricted to a small area, by 1910 organized successful cooperatives that prevented the depressing surpluses that affected cotton and tobacco farmers whose cooperative attempts failed. It proved difficult to organize small-scale cotton and tobacco farmers--indeed, it

> took federal programs to curtail production. These and variations offer contrast in assessing how the transformation occurred and how each commodity culture evolved uniquely into agribusiness. Certainly other commodities such as sugar, peanuts, and soybeans offer different insights; still cotton, tobacco, and rice offer a starting place for assessing the impact of government and machines on the South. (Daniel, 1985: xii-xiii).

Perhaps no commodity better reflects the manner in which government policy can influence cultural practices and the types of technology used than tobacco. This commodity until recently represents how government policy can maintain small-scale production while almost all other agricultural commodities have moved toward greater concentration. Even today, tobacco remains a highly labor intensive cultural operation. Neither the scale of operation nor the labor-saving technologies used at the time of the Great Depression have changed markedly. The primary factor influencing this seeming anomaly is the allotment system which controls the amount of tobacco each producer can raise. While some technological change has occurred, it has been limited primarily to land-saving technologies such as ferilizers, herbicides, and pesticides. Should the production control system be significantly altered, it is quite likely that the character of tobacco production, especially its use of labor-saving technologies will more resemble other commodities.

Still another example of the South's unique course of technological change was the very slow adoption of multi-use tractors. Sargan (1979) has documented this uneven use of a common farm technology in an econometric study of differential adoption rates of tractors between the North and South. Sargan argues that even when the South did rapidly adopt tractors after the Great Depression that was still more efficient to use a six-horse team to till the soil on most southern farms. Vandiver (1978) suggests that the adoption of tractors in cotton production may have been more due to the organizing efforts of sharecroppers than to the demands of economic efficiency. Hence, it is possible that among some southern landowners the historical reliance upon sharecropping may have ended to what they perceived as an unreliable labor force--due to the threat of unionization.

These observations demonstrate the need for at least a glancing familiarity with the South's history. The next section and Appendix A provide a brief historical overview of southern agriculture and rural community change.

SECTION 3

Historical Background and Literature Review

Historical Background

The economic and social history of the South is characterized by radical economic and social upheaval. The legacy of the antebellum period still persists in subtle forms, particularly in the structure of agriculture and rural community social organization. Southern society has been characterized by a dependency upon agricultural production for more than 200 years. However, the types of commodities produced, the variety of social and economic relationships used to produce agricultural commodities, and their distinctive market structures have been associated with relatively unique types of local societies (c.f., Genovese, 1965; Hahn, 1983). Three types of agricultural production systems coexisted during the antebellum period: (1) slavery and the plantation system, (2) commercial family farming, and (3) subsistence family farming.

The plantation system emerged under the peculiar conditions of colonial America. Land was plentiful, but cheap agricultural labor was scarce. Large-scale commercial agricultural production on the periphery of the British political and economic empire was unlikely unless a relatively reliable low-cost labor force was available. Black slaves and indentured servants provided such a labor pool. However, in adopting this type of production system, planters set in motion a political and economic system that would be responsible for a national civil war and the slow uneven industrialization of the South (Genovese, 1965).

The plantation system retarded the development of manufacturing and other industrial enterprises in the South. Unlike the emerging capitalist economy of the North, which demonstrated a remarkable if often brutal capability to react to the pressures of competitive markets, the planter class could not react effectively to changing market conditions and tended not to reinvest a greater part of its profits in production. This was particularly true for agricultural technologies that required both capital and skilled labor. In addition, the planter class actively discouraged the development of internal markets that would have aided the fledgling commercial and subsistence family farms to increase their productivity as their counterparts in the North were able to do (Hahn, 1983). The low demand for highly productive agricultural machinery among planters and yeoman farmers contributed to the slow development of Southern industry, while simultaneously creating an economic dependency upon Northern industries for capital goods. Furthermore, the planter class was not eager to have either a yeoman farming hinterland or an urban industrial elite, similar to the North, compete with it for power in the region.

The Civil War ended slavery as a labor system, but it did not end the political and economic power of the plantation class (Billings, 1978; Kirby, 1983; Mandel, 1978; Mann, 1984; Shlomowitz, 1984). The cotton plantations were subdivided into sharecropping units, and the sugar cane plantations remained relatively intact through the employment of labor gangs. While the Civil War may not have eliminated the infant internal market, it certainly destroyed much of the transportation and communication infrastructure. As a result, commercial family farming lagged in its technical and economic development -relative to the rest of the country. The social and economic changes following the Civil War were enormous in depth and magnitude. The legacy of slavery and the reactionary Jim Crow political movements after reconstruction provided a legal structure that reified a caste-like system, which kept most blacks at the periphery of an already marginal economic region.

The South's nonfarm rural economy has experienced at least two periods of significant industrialization. The first period occurred in the latter part of the nineteenth century. During the antebellum period the anti- industrial policies of the plantation class subverted the emergence of nonfarm industries. However, planter capital facilitated the emergence of rural industrialization (see Billings, 1979) by establishing small textile mills along the piedmont fall line that primarily employed white labor. The availability of indigenous capital after the Civil War appears to have varied by region. While Billings (1979) provides evidence that former plantation owners and wealthy farmers invested heavily in new manufacturing enterprises, Mann (1984) proposes that among the Gulf states, such heavy investment was not as common.

In terms of the economic and social fabric of the rural South, this industrialization provided a source of nonfarm employment that could compete for labor and capital with the farm sector. However, the persistence of racism limited the entry of blacks into many of these nonfarm industries, thus keeping them in agriculture - particularly in sharecropping. This type of extreme segmentation of the rural labor force persisted until the mid-1950s when the next significant period of rural industrialization occurred. The demise of sharecropping, primarily due to the consolidation of large land holding through the use of labor-saving machines (see Vandiver, 1978), released large amounts of agricultural labor, especially black labor. The rapid success of the civil rights movement in the 1950s and the 1960s made it easier for blacks to move into industrial jobs once reserved for whites. This second period of industrialization greatly altered the dependency of the rural labor force and rural communities from agriculture to nonfarm industries. For example, the estimated average percent of nonmetropolitan workers employed in manufacturing between 1983 and 1984 was above 30 percent in Alabama (36%), Georgia (33%), North Carolina (36%), South Carolina (37%), and Tennessee (39%). However, as Horan and Tolbert (1984) have demonstrated, nonmetropolitan employment continued to be low wage and segmented by race and sex.

By 1970, the base year for this study, sharecropping and the old-style tenancy had virtually disappeared as important social forms of agricultural production. Furthermore, commercial family farming was showing some of the decline already evident elsewhere in the nation. Perhaps most importantly for the well-being of rural communities, nonfarm employment was by then the principal source of rural livelihood.

The South's history is not only unique, but it helps explain the uneven development of its metropolitan and nonmetropolitan areas. Appendix A provides a more detailed discussion of this history with special emphasis on the factors leading to the demise of slavery, the transition to sharecropping, the rise and apparent decline of commercial family farming, and the introduction of peripheral nonfarm industries into the rural economy.

Literature on Farm and Community Change

From the earliest days of the colonial period, there was a clear association between the well-being of an agricultural trade center and its farming hinterland. Indeed, among preindustrial agrarian societies, the former was economically and socially dependent upon the viability of the latter. As farming became more commercial, the functions of the trade center relative to its farming hinterland changed from simply a market for local exchange of commodities and services or the focus of noneconomic community institutions to that of a local mediator of external trade within regional, national, and eventually international markets. Similarly, as the demands of commercial farming altered the technological, social relational, and economic rationality of farming, these changes were likely to have been reflected within the trade center in the form of new retail establishments specializing in the selling of necessary production inputs (no longer supplied within the farm gate) and in transferring farm commodities to external markets.

However, while the emergence of regional markets created possibilities for commercial farming, there was also the likelihood that trade centers, due to their geographical centrality or scale of economic and social differentiation, offered special advantages to nonfarm enterprises. As these nonfarm interests expanded their economic influence, the rural trade centers' economic and social dependency upon their changing farming hinterland was diminished. Certainly, some businesses and people continued to be highly dependent upon farming. However, at an aggregate level, the general economic and social well-being become more influenced by changes among various nonfarm enterprises. The greater the transition from farm to nonfarm dependency of a farm trade center, the less likely changes in farming were to cause an improvement or decline in its economic and social well-being.

Until recently, academic discourse on the relationship between farm and community change has been almost unswervingly directed by Walter Goldschmidt's study of Arvin and Dinuba, California. A more detailed discussion of this study occurs in Appendix B, so only a brief description of it principal hypothesis is necessary here. The primary assumption is that large-scale farms that are characterized by industrial relations of production will vary inversely with community quality of life. Conversely, medium-scale family-type farm operations where the family owns and operates the farm with a minimal dependence upon hired labor will vary positively with community quality of life. An implicit assumption is that farm change toward a more industrial form of workplace will be associated with a decline in community well-being. As will be noted in Section Six, this thesis may be just as easily applied to nonfarm enterprises.

Not only has the Goldschmidt hypothesis demonstrated an unusual resiliency over the past four decades, it represents the primary hypothetical framework guiding this and the other four regional studies. Part of its resiliency is due to two loose replications during the latter part of the 1970s in the San Joaquine Valley (Fujimoto, 1977; Petterson, 1977). Both studies reported findings similar to Goldshmidt's 1944 report. The virtual absence of change over the four decades should have raised questions of how these two towns could have remained almost unchanged while elsewhere there was considerable farm and community change (see Whiting, 1974).

In fact, both agricultural economists and rural sociologists in recent years have questioned the regional controls (Hayes and Olmstead, 1984), the farm structure (Goss, 1979), and the unicausal direction of farm change causing community change and not vice versa (Swanson, 1982). Furthermore, two studies outside of California, which partially tested the Goldschmidt hypothesis, suggest important modifications (Flora, et al. 1979; Swanson, 1982). Appendix B presents a more complete discussion of the literature addressing farm and community change.

MacCannell and Dolber-Smith (1985) in a companion study to this one propose that the Goldschmidt hypothesis not be treated as a linear relationship. Instead, they make a good argument for a curvilinear relationship. As average farm size increases from small farms to farms of medium scale (e.g., \$100,000 to \$250,000), community well-being will likely improve. However, at a presently undetermined threshold, further increases in the average scale of operation will lead to a decline in community well- being.

These critiques and anomalous findings do not necessarily refute the Goldschmidt hypothesis. Rather, they suggest important conceptual and methodological qualifications. First, instead of a linear relationship between farm scale and community well-being, the relationship may be curvilinear. Second, the greater a community's dependency on nonfarm industries, the less likely a shift toward large-scale agriculture will adversely affect its overall well-being. Third, the transfer in the dependency of trade centers from their farming hinterland to nonfarm enterprises may suppress an adverse relationship between farm scale and community well-being in an aggregate analysis such as the one that follows. Furthermore, it is very possible that people's lives can be traumatically altered due to farm change without the larger community sharing in the grief. It is equally clear that a strong agricultural economy, such as MacCannell and Dolber-Smith (1985) report for the agriculturally industrial states, might be associated with a deterioration in community well-being (since hired workers generally do not benefit from such wealth).

SECTION 4

Technology, Policy and Markets: Possible Scenarios for Southern Farms

Previous sections have provided a foundation for assessing the role of history, technology, policy, and markets in the future of farm structure in the South. This section highlights critical technologies, policies, and market forces that will shape the six dominant types of southern farms. Although a focus on farm types is somewhat limited in terms of a full consideration of how production patterns may change in the South, it does provide a nice tie to the emerging technologies. In the Schertz book Another Revolution in U.S. Farming?, McArthur summarizes the trends in southern farms:

> New patterns of structure and organization appear possible for southern farms of the future. The emerging pattern appears to be: (1) a relatively large number of small farms (essentially part-time and part-retirement farms); (2) an increasing number of large to very large farms operated under a corporate or partnership form of organization. Small farms benefit from the growth of off-farm employment opportunities in the South. Present economic conditions and those being projected for the future enhance chances for survival of large farms, in contrast to the traditional medium-sized family farm (pp. 303-304).

In recent years, such a bimodal trend has existed. In fact, policies that would reverse the trend are extremely unlikely since, such policies would require a political movement to redistribute wealth on a scale that would dwarf the New Deal. Further, policies that would maintain the current structure would also require major political action. Therefore, this section focuses on three more likely scenarios: (1) maintaining the current trends, (2) slowing the current trends, and (3) accelerating the current trends. No attempt is made to quantify probable future farm structures for the South. Rather, qualitative assessments are developed.

In general the farm models developed in Appendix C demonstrate how technological adoption rates are related to growth in farm size and declining farm numbers. There is clear evidence that as land-saving (i.e., chemicals and fertilizer) and labor-saving (i.e., machinery) technologies are adopted, farm size will increase (see Table C.4 in Appendix C). The strongest association appears to be between land-saving technologies and farm size (i.e., land-saving technologies are more related to increases in farm size than labor-saving technologies). Further, although land-saving technologies also inflence the change in farm numbers measure, labor-saving technologies do not appear to cause significant changes in farm numbers within counties. Another conclusion that is supported by analysis presented in Appendix C is that as farm size increases dependence on non-family labor increases.

Farm Change in Southern Beef Farms

Beef farms (excluding feedlots) comprise 33 percent of the total farm numbers in the South. Yet, 86 percent of the farms are extremely small (i.e., total farms sales of less than $10,000). In fact, over 28 percent of the farms in the South are beef farms with sales of less than $10,000. Therefore, in terms of farm numbers, the southern beef sector provides the greatest potential for change. Why have southern beef farms remained so small? It has been argued that beef farming is a consumption good. Part- time farmers enjoy the lifestyle associated with raising a few beef cattle. If this is true, then it is likely that tax laws also play a role. Beef cattle raised for breeding purposes can be counted as capital gains income. This provides a tax shelter for those who wish to raise a few beef cattle in a leisurely manner. Elimination of capital gains tax advantages would very likely reduce the number of beef farms in the South by reducing the tax advantages for small part-time farmers. Therefore, the bimodal trend discussed above would be slowed.

Most of the beef operations in the South are cow-calf farms depend heavily upon pasture. Therefore, emerging technologies that will increase beef cattle forage utilization obtained from grazing present potential change. Such technologies could increase the comparative advantage of beef for the southern region versus other parts of the country. This would also potentially provide incentives for southern beef farmers to expand their herd size. However, using the argument that the smallest farmers are slowest at adopting new technologies raises some doubt regarding how much herd expansion will occur. Further, it may be the mid-sized farms that adopt this new technology. Thus, such emerging technologies also have the potential to slow the current trends in southern farm structure. On the other hand, embryo transplant technology will very likely be adopted by the largest beef producers.

Farm Change in Southern Tobacco Farms

Tobacco farms comprise nearly 21 percent of the farms in the South. Future government supply control and pricing policies should play a role in the future structure of these tobacco farms. Two types of tobacco dominate: (1) flue-cured tobacco in the Carolinas, and (2) burley tobacco in Kentucky and surrounding states. Both programs now allow for intra-county leasing of tobacco quota allotments. Before this program change, only owners of a quota could grow tobacco. Thus, since tobacco production has been extremely labor intensive, there was little incentive for labor- saving technologies at least among smaller operations. Flue-cured leasing occurred a decade before burley (1961 versus 1971), and labor-saving technological development in flue-cured production is probably that many years ahead of burley. Although it can be argued that other factors had a significant influence on this technological development, the leasing change was also a factor. The design of supply control programs can alter the demand for technological development.

Since flue-cured tobacco production has largely gone to labor-saving technology, the number of quota holders who grow their quota has declined dramatically (i.e., the economies of size are such that tobacco growers expand their operation by leasing quotas). The burley belt continues to have a larger share of quota holders who grow their quota (one-half versus one-quarter). Thus, one impact of elimination of the supply control provisions of the tobacco program would likely be an increased demand for labor-saving technologies. Over time, such technologies would contribute to concentration in the production of tobacco and increases in farm size. This would be more the case in the burley belt than in the flue-cured region. Yet, shifts in production of flue-cured tobacco could be expected. The topography of the Carolinas is such that the eastern sections are more suitable for machine harvest than the western regions. Therefore, with the elimination of county-restricted quotas, flue-cured production may move to the eastern sections.

In short, elimination of the supply control provisions of the tobacco program would likely cause a restructuring of tobacco production as new technologies are adopted. To the extent that off-farm jobs are available, producers with small farms would be even more likely to cease tobacco production. In those regions where off-farm jobs were not available, producers with small farms would be forced to accept a lower return on their labor to compete with farmers using labor-saving technology. Thus, the two largest factors in determining how tobacco will change farm structure in the South are the tobacco program and local job opportunities.

Cash Grain Farms in the South

Three cash grains dominate: soybeans, corn, and rice. Each of these has different government programs and markets. In total, cash grain farms account for roughly 16 percent of the farms. Cash grain production in the South is generally less concentrated than in the rest of the U.S. (the notable exception is rice production, which is more heavily concentrated). In fact, 46 percent of the cash grain farms are quite small (i.e., sales of less than $10,000 in 1982).

Two emerging technologies that should influence the structure of cash grain farms are pest control and biotechnologies. Since the South is more vulnerable to pests, breakthroughs in pest control could increase the South's competitive position vis-a-vis other regions (Office of Technology Assessment). Large farms would very likely be the beneficiaries of such breakthroughs. This would also be true for any breakthroughs in biotechnology. Since there are a larger number of small grain farms in the South than in the remainder of the U.S., such technological developments have more potential to change farm structure.

Given that the outlook for grain production is highly dependent upon international markets, U.S. international trade policy and macroeconomic policy will play a major role in the future of grain production. In the unlikely event that a resurgence of world demand for grain occurs, production in the South would increase. Government programs that reduce interest rates and, thus, the value of the dollar are key elements to such a resurgence.

Finally, changes in commodity programs could also change the structure of cash grain farms. More reliance on supply control programs would facilitate maintenance of the current structural trends. Continuation of high price supports and target prices (relative to world markets) should accelerate the current trends. And elimination of or sharp reductions in price support levels would reduce the number of small farms and eventually, because of the asset value relationships, reduce the rate of concentration of the largest farms (mid-sized farms would not disappear as fast).

Poultry Production in the South

Unlike beef and cash grain farms, poultry is already a highly concentrated industry. Rogers (1979: pp. 148-149) has summarized the poultry and egg industry as follows:

> [The] typical commercial poultry farms are large, and many exceed one-man size. Depending on the degree of mechanization and production practices, one man-year of labor is required per 20,000 to 25,000 laying hens, each 4.5 to 5 batches of 30,000 to 50,000 broilers, or each 10,000 to 30,000 turkeys per year in several batches.... Today's poultry and egg industries involve an extensive network of linkages which have developed between production units and input supplying and marketing functions.

The poultry and egg industry, then, is not only highly concentrated but it also is vertically integrated into larger agribusiness firms.

The structural characteristics of poultry and egg operations vary by region and scale of operation. However, two types appear to be dominant: (1) industrial-typefarms, and (2) propertied laborer farms. Heffernan (1984) has examined the poultry operations among the delta states in some detail. He describes highly vertically integrated operations on which the operator may not be the owner and on which there is a relatively large number of hired workers. Davis (1980) describes a similarly vertically integrated operation, but it is one with a single operator. He refers to this type of farm structure as a "propertied laborer," since the operator may own the land and buildings but does not own the chicks and hens and is expected under contract to follow strict, prespecified management procedures. These farms tend to be smaller than the industrial-type farms.

The poultry and egg industry in 1982 accounted for 24.4 percent of the region's gross sales but only 4.1 percent of all farms. Approximately 62.2 percent of the farms had sales greater than $100,000, while only 7.4 percent of the farms reported sales of less than $10,000. While these figures do suggest a great deal of concentration already exists, there is still room for further decreases in farm numbers and increases in farm scale. Among farms with more than $100,000 in sales, only 11.1 percent have sales of $500,000 or more. It is conceivable, given the Office of Technology Assessment's projections for changes in poultry and other animal research, that increased efficiencies may be achieved.

It is likely that the "disappearing middle" phenomenon will continue to characterize the poultry and egg farm industry change. With such a small proportion of poultry and egg farms in the highest sales categories, it is possible that medium-sized farms ($100,000 to $499,999 in sales) will be reduced in proportion to the very large operations ($500,000 or more). However, it is also possible that the very smallest farms will find it difficult to compete with the very largest farms as well, and they may also find it increasingly difficult to arrange vertical contracts with poultry agribusiness firms. It should be noted that these are only qualitative estimates based upon past trends.

Dairy Farms in the South

Dairy farms in the South comprise approximately 3 percent of the farm numbers and account for 9 percent of the total value of agricultural products sold. The dairy farm structure is dominated by mid-sized farms. A bimodal trend is highly unlikely. Instead, the emerging technologies (bovine hormones, computer-assisted management, etc.) are likely to favor the larger farms. Dairy commodity policy will play a major role as well. As program price supports are reduced, smaller farms will lose their competitive position. Therefore, most of the foreseeable changes in dairy policy will contribute to farm concentration.

Cotton Production in the South

Cotton production is primarily concentrated in the Mississippi Delta region (Tennessee, Arkansas, Mississippi, and Louisiana) though all of the South Atlantic states report some cotton sales. Since the Civil War, cotton production has tended to shift westward in order to take advantage of more fertile soils while reducing pest damage (Mann, 1984; Starbird, 1984). For the cotton-growing states in this region in 1982, 41.6 percent of the cotton farms had sales of $100,000 or more, and only 19.9 percent reported sales of less that $10,000. Regionwide, only 1.2 percent of the farms rely on cotton for at least 50 percent of their gross sales, and cotton accounts for only 5.2 percent of the South's gross agricultural sales.

As with poultry, cotton production is primarily concentrated on medium- and large-scale operations. Therefore, the trend toward a disappearing middle will apply only to the medium-sized farms. There will likely be no increase among small cotton producers. However, the potential loss of medium-sized farms is considerable. Approximately 43 percent of all cotton farms reported gross sales between $40,000 and $249,999.

Changing agricultural technology in cotton has been a very important factor in facilitating farm concentration (McArthur, 1979; Sargen, 1979; Vandiver, 1978). Furthermore, land-saving technologies that aid in weed and insect control as well as fertilizers have increased the amount of cotton raised on an acre. Emerging cotton technologies are likely to facilitate productivity, thus contributing to the continued concentration of cotton production.

Historically, government farm programs have influenced cotton prices and production (see Starbird, 1984 for an excellent short review of government cotton programs). Generally, recent participants in the cotton program have benefited, both directly from price supports and direct payments and indirectly through higher market prices. However, the "longer term effects of farm programs on the well-being of farmers and the cotton industry are still unclear" (Starbird, 1984: p. 25). As with other commodity programs, cotton is presently in excess supply. Given the price support system, which generally acts as an incentive to both technological research and to concentration (see conceptual section 2), the continuation of present policies are not likely to deter further concentration.

SECTION 5

Methods and Results of Community Well-Being Analysis

Methods of Research

The assessment of how farm change and community well-being are associated with one another, and the implications for the future are based upon: (1) the proceeding conceptual framework, and (2) an empirical macro- analysis of various dimensions of this association as can be measured with available secondary data for the period between 1969 and 1980. The objectives of this empirical investigation are twofold: (1) the analysis of farm technology and farm structure, and (2) the analysis of farm structure and community quality of life. In each case, several key control variables are introduced in order to develop a more completely specified model. The details of the methods used in this report can be examined in Appendix C.

While this research tests the general proposition of the Goldschmidt hypothesis, the unit of analysis is the county and not the community. This is an important difference between this study and Goldschmidt's examination of Arvin and Dinuba. A county may have many different communities within it that have great differences in the degree of their dependence upon farming. From a methodological standpoint, it is entirely possible that communities that are highly dependent upon agriculture within a county may have the total effect of their association with farming statistically suppressed. Such an aggregation bias is inherent when using county as a unit of analysis. Unfortunately, there are no secondary data sources at the community level for farm structure, community well-being, and the necessary control variables. Therefore, the empirical portion of this report will examine county farm structure and measures of county well- being. It is important, then, that the reader keep this distinction between the study's unit of analysis and its concept of community in mind when interpreting the results and making assessments for the future.

The data for this study were taken from three reliable and well-documented sources: the Census of Population, the Census of Agriculture, and the County, City Data Book. Twelve farm-related and nine community- related variables were employed. Table 5.1 lists the variables used in this report, along with their operational definitions. Appendix C presents a more detailed discussion of the validity of the epistemic links between each concept and its operational definition.

Data in Appendix C were analyzed in two stages. First, cross-sectional linear regression models were constructed and their results analyzed for 1969/70 and 1978/80 for farm structure and community well-being. Second, the ways in which these models changed for the two points in time were analyzed. For this second stage, an additional control variable was included, the 1969/70 value of the dependent variable. This control permits the researcher to estimate the importance of uneven development while simultaneously controlling for the dependent variable's value at the first point in time. Such a control is mandatory for this type of panel analysis (Kessler and Greenber, 1982).

It should be noted that these models utilize statistical techniques based upon the assumptions of ordinary least squares. In other words, the statistical techniques only assess linear relationships unless otherwise specified. However, by using a quadratic equation it is possible to test for MacCannell and Dolber-Smith (1985) hypothesis of an inverted "U" relationship between farm concentration and community well-being. This is accomplished statistically by including the squared value of the appropriate independent variable--in this case average farm scale. As will be seen later in this section, only one of the dependent variables--percent of the labor force that is unemployed--was substantively associated with the quadratic equation of average farm scale. The use of a quadratic equation represents a test of an alternative hypothesis to that offered by Goldschmidt.

It is very important to note that none of the farm structure and community well-being models in Appendix C or in the following analysis is fully specified. Indeed, each type is missing empirical measures of key concepts. While Appendix C identifies the principal deficiencies in detail, some of the more important concepts need to be mentioned here. Among the farm structure models, there are no data available at the county level from the Census of Agriculture on debt-asset ratio. Clearly, the importance of this type of ratio for estimating the economic and structural viability of farming and the likelihood of major structural change are critical. Furthermore, there were no data available for farm prices and demand. In other words, the farm structure models do not contain essential information on the farm market-place.

Among the community well-being models, the most obvious omission is race. These models do not provide data on the number of black families in the county or the number of black farm families. Yet, as the historical discussion presented in Appendix C emphasizes, the enduring effects of the plantation system are likely to influence indicators of both farm structure and community well-being.

Another problem of specification is the absence of subregional controls. Unlike the other studies of this task force, the South is characterized by multiple geographical and economic regions. For example, this region contains the traditionally poor Appalachian counties, the Piedmont of the Southeastern states, the coastal plains from North Carolina to Mississippi, and the delta region of the Mississippi River. The empirical results must be interpreted as being Southern associations. Considerable internal variation can exist while being suppressed in aggregate analysis such as this. Therefore, the reader must be careful to interpret the findings as regional associations that may not be generally inferred to specific local conditions.

Table 5.1: Variables and Measures Used in Farm Structure and Community Well-Being Analysis

Variables:	Measurement Description
Farm Variables:	
Farm Number	Farm number was measured directly as the number of farms reported by the 1969 and 1978 Censuses of Agriculture.
Average Farm Size Sales	Farm size was measured directly as the average gross sales per farm. This was computed by dividing a county's total agricultural sales by the county's total number of farms.
Percent Part-Time Farms	Part-time farming was measured indirectly as those farm operators who stated that they worked over 99 days a year off of the farm. This number was then divided by the total number of farms in a county.
Land-Saving Tech. Expenses p/fm	Land-saving technology expenses per farm was computed summing total county expenses for fertilizer and other production chemicals and then dividing the sum by the total number of farms in the county.
Average Value of Machinery p/fm	Average value of machinery per farm was computed by the Census of Agriculture.
Non-Family Labor Expenses p/fm	Non-family labor expenses per farm was computed by summing total expenses for hired and contract labor in a county and then dividing the sum by the total number of farms.
Concentration of Small Farms	This is an indirect measure that uses the principle of a Gini coefficient. It is the proportion of farms with less than 180 acres.
Percent Full-Owner Operator	This variable is measured directly as those operators reporting that they own all of the farming operation.
Percent Tenant Operator	This variable is measured directly as those operators reporting that they own none of the farming operation.
Percent of Grain Sales	This variable is measured directly as the total dollar amount of grain sales in a county divided by the total gross agricultural sales in a county.
Percent of Live-stock Sales	This variable is measured directly as the total dollar amount of livestock sales in a county divided by the total gross agricultural sales in a county.

Table 5.1 (cont) - Variables and Measures Used

Community Well-Being Variables:

Percent of Pop. Unemployed	This variable is measured directly as those individuals reporting they were unemployed at the time of the census enumeration.
1970 Value of Dependent Var.	This variable is only used for the change models and is the dependent variable's 1969 or 1970 value, depending upon when the data were collected. The population variables are 1970 and farm variables are 1969.
County Population	The total population of a county as reported by the census of population.
Percent of Families Below Poverty	This is measured directly by the census of population and refers to all families who reported incomes below the poverty level.
Median Family Income	This variable is measured directly as the family whose income has half of all families below and half of all families above it in terms of family income.
Number of Retail Establishments	This data is measured directly and is published by the County City Data Book.
Property Taxes Per Capita	This data is measured directly and is published by the County City Data Book.
Percent Farm of Rural Pop.	This variable is measured directly as the total number of the farm population divided by the total rural population in a county.
Percent in Manufacturing	This variable is measured directly using the industry code in the census of population. The total number of people employed in manufacturing is divided by the county's entire labor force.
Percent in Service Industries	This variable is measured directly using the industry code in the census of population. The total number of people employed in service industries is divided by the county's entire labor force.
Proximity to SMSA	This measure is based upon a county's geographical position relative to metropolitan areas of different population sizes. The measure was developed by Calvin Beale.

While these shortcomings are important, nonetheless these are the most completely identified models of farm and community change in the South to date. That they are lacking measures of potentially key concepts suggests that more research is necessary in the future. However, while we believe that these models can be more accurately fine tuned, the general tendencies emerging from the results are not likely to be altered, only made more specific.

The Present Study

The purpose of this study is to assess the association of selective farm structure indicators with county well-being, while controlling for potential nonfarm economic influences. This is a general test of the Goldschmidt hypothesis since indicators of farm structure are included in three different models of county well-being. Only three of the six quality of life dependent variables discussed in detail in Appendix C are examined: (1) level of unemployment, (2) median family income, and (3) percent of families below poverty.

As noted above, two cross-sectional analyses are used to determine how the independent variables are associated with the dependent variables in 1970 and 1980. This analysis will provide evidence of the relationship among the farm structure variables and the three measures of county well- being. The cross-sectional analysis is accompanied by an examination of how change among the independent variables is associated with change among the three dependent variables between 1970 and 1980. This research design not only tests the Goldschmidt hypothesis at two points in time, but also permits the analysis of how change in farm structure is associated with change in county well-being, controlling for several nonfarm economic variables. Goldschmidt did not empirically examine how farm change influences community well-being over time. Furthermore, by incorporating a quadratic equation we also were able to test the MacCannel and Dolber-Smith hypothesis.

The cross-sectional analysis is comprised of four indicators of farm structure. First, average farm scale is measured in gross farm sales. Second, concentration of smaller farms is measured as the proportion of farms with fewer than 180 acres. As noted in Appendix C, number of acres is a poor measure of farm scale. However, it is difficult at best to estimate change in the distribution of sales categories during this period due to high inflation. This forced us to use a distributional measure of scale that would be consistent for two points in time, i.e., acres of farmland. The third indicator is the percent of farm operators working 100 or more days off the farm. Fourth, farm population as the proportion of the county's rural population is used. This latter measure is an indirect indicator of the rural economy's dependency upon farming. These same variables were used for the change analysis as well. In addition, the analysis of change between 1970 and 1980 included a fifth farm indicator, change in farm numbers.

If the Goldschmidt hypothesis is correct for both cross-sectional analyses, average farm size will be positively associated with the level of unemployment and the level of poverty but negatively associated with median family income. However, the opposite association will be expected for the indicators of small farm concentration and the rural population's dependency on farming. In the case of the change models, the Goldschmidt hypothesis predicts that change in farm numbers should be positively associated with change in the median family income and negatively associated with change in the level of unemployment and poverty. Finally, the quality of life models for unemployment and poverty will have as an independent variable the level of unemployment.

Goldschmidt does not directly address the phenomenon of part-time farming. However, Swanson's study as well as the work of Bonanno (1985) suggest that part-time farming may be a function of nonfarm employment opportunities. Bonanno argues that part-time farming can represent a type of "welfare" function for rural areas and a labor pool for nonfarm industries. Swanson's work suggests that entry into part-time farming may slow the transition to a highly concentrated farm structure. Therefore, part-time farming is included for reasons other than the Goldschmidt hypothesis.

Three control variables are used: the percent of the county's workforce employed (1) in manufacturing and (2) in service industries, and (3) the county's proximity to metropolitan areas. Both manufacturing and service industries represent the most likely arenas for nonmetropolitan employment. In fact, these two indicators accounted for just over 46 percent of the nonmetropolitan employment in 1980. In Swanson's study, when these two forms of employment were treated together, they were the principal influence on a rural trade center's population change. The third variable is similar to Swanson's control for a trade center's position within the hierarchy of places within the regional economy. Those places that are the farthest away from large metropolitan centers are assumed to be the least likely to experience the immediate benefits of favorable economic change but the first to experience downturns in the regional economy.

This study, then, attempts to go beyond the simple unidirectional effects of the Goldschmidt hypothesis by including indicators of regional economic conditions. By including four indicators of farm structure, we expect to give the Goldschmidt hypothesis a fair chance to be associated in a least one of several dimensions of farm structure. It is possible that if these variables were highly correlated with one another, anyone one of them might suppress the variance with the dependent variables of the remaining farm variables. However, none of the correlations were so high as to invite such a statistical suppressor effect. As already noted, we make no claim to having a fully specified model. But we do believe that the three models of quality of life for two points in time, as well as for change between the two points in time, provide at least a partial test of the Goldschmidt and MacCannell and Dolber-Smith hypotheses.

The Findings - Does Farm Structure Influence County Well-Being?

The findings are presented in three tables. The first and second tables present the cross-sectional analysis for the three quality of life indicators, while the third table presents the results for the change scores. Only the most noteworthy results are discussed in the findings section.

We examined both the Goldschmidt and the MacCannell and Dolber-Smith hypothesis. For two of the dependent variables--median family income and percent of families below poverty--the use of a quadratic equation made no substantive contribution to the analysis. Therefore, we retained the linear assumptions of the Goldschmidt hypothesis, which assumes as average farm size increases median family income will decrease while the percent of families below poverty will increase. However, for the third dependent variable--percent of the labor force unemployed--there was a clear support for the MacCannel and Dolber-Smith hypothesis. With the Goldschmidt assumptions there was a significant negative relationship between average farm size and unemployment with a standardized regression coefficient (referred to as Beta or B in the discussion below) of -.145 for 1970 and -.160 for 1980. [It should be noted that Goldschmidt would have hypothesized a positive association.] However, as will be noted below, the quadratic function provides a much better fit for both points in time. Therefore, in both Table 5.2 and Table 5.3 the quadratic equation for average farm scale is included for the dependent variable of unemployment. The quadratic equation was not used in the change model since an inverted U relationship is not expected.

Table 5.2 presents the results for the cross-sectional analysis for 1970. Average farm size is significantly associated with each of the dependent variables. However, the direction of each association is not in the direction anticipated using the Goldschmidt hypothesis. Counties with larger average scale farms were more likely to have higher levels of median family income and lower percentage of families in poverty in 1970. Furthermore, in counties where the rural population was more dependent upon farming, median family income was likely to be lower.

The quadratic equation had two very strong associations with the level of unemployment (B = -.970; B = .824). This would indicate that as the scale of farms increase from the very smallest farms to medium sized farms (about $54,000 in annual gross sales) unemployment decreases. However, as farm scale increases from medium sized to very large scale unemployment increases. This finding correspond very well with the MacCannell and Dolber-Smith hypothesis. It is the medium sized farms that are most likely to be associated with low levels of unemployment. Counties with either small scale and very large scale farm averages are most likely to be associated with relatively higher levels of unemployment. None of these results is consistent with the Goldschmidt hypothesis, with the notable exception that as farms increase from medium scale to very large scale unemployment is likely to increase. This is interesting since Goss (1979) argues that Goldschmidt's Dinuba farming hinterland was primarily made up of

Table 5.2 -- Cross-Sectional County Well-Being in 1970 (N=706)

Independent Variables	Percent of Labor Force Unemployed	Median Family Income	Level of Poverty
Intercept	1.1231* (.000)	21035.0* (.000)	13.353* (.000)
Average Farm Size	-.00012* (-.970)	.0201* (.218)	-.00007* (-.130)
Quadratic Value (Farm Size)	1.1827* (.824)	N.A.	N.A.
Concentration of Small Farms	-1.1149 (-.063)	-4.807 (-.000)	-1.9386 (-.025)
Percent Part Time Farms	-2.7632* (.127)	-5459* (-.188)	-24.286* (-.254)
Percent Farm to Rural Population	1.09470 (-.057)	-5318* (-.215)	6.4198 (.079)
Percent in Manufacturing	-4.9338* (-.258)	1916 (.076)	-8.7488 (.106)
Percent in Services Industries	-3.7876 (-.046)	-19791* (-.187)	81.300* (.235)
Percent of Population Unemployment	N.A.	-417.8* (-.312)	1.3141* (.300)
Proximity to a SMSA	.1235* (.074)	-0.169* (-.395)	2.2393* (.321)
R2	.200*	.529*	.458*

* = Statistically Significant at .01 level
Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient gives an indication of the relative statistical importance of that particular variable.

larger-than-family farms which were likely to be medium sized farms--not small scale family farms as is often assumed.

In 1970 part-time farming was positively associated with median family income and negatively associated with the percent of families in poverty. This supports Bonnano's (1985) observation that part-time farming may serve as a type of welfare function, since levels of median family income increase and poverty decreases in counties with more part-time farm operators.

Counties with a higher proportion of their labor force in manufacturing were likely to have lower levels of unemployment. But the proportion of the labor force in manufacturing is not associated with either median family income or poverty in 1970. Service industries, on the other hand, are negatively associated with median family income and positively associated with poverty. Not unexpectedly, counties with high levels of unemployment also had lower levels of median family income and higher levels of poverty.

Table 5.3 presents the results for the 1980 cross-sectional models. These findings are not entirely consistent with 1970, suggesting that important changes may have occurred during the decade. While concentration of small farms is not associated with any of the dependent variables in 1970, by 1980, counties with a higher proportion of small farms were likely to have higher levels of unemployment but lower levels of poverty.

The quadratic function for average farm scale, however, continues to have the same association as it had in 1970. In 1980 the standardized regression coefficients were -.705 and .555 for the simple farm scale variable and the squared farm scale variable respectively. As in 1970, these betas suggest that counties with relatively small average farm scale are more likely to have higher levels of unemployment than counties with medium scale farms (which in 1980 were about $118,000 in average farm sales). This might reflect the historical legacy of sharecropping, which was relatively small scale in operational size. It also might reflect regional differences, with Appalachian counties and coastal plain counties having tobacco tenant farms which also have relatively small scale. Similarly, counties with very large average farm scale were more likely to have higher levels of unemployment than counties with medium scaled farms. This phenomenon, as in 1970 might indicate that there is a large pool of unemployed farm workers waiting for employment in the relatively large scale cotton, rice, and sugar operations.

A comparison of the two cross-sectional models indicates that the Goldschmidt hypothesis is not particularly applicable to the nonmetropolitan counties of southern and border states, even when several nonfarm economy variables are controlled. In 1980, counties with a higher proportion of their labor force in manufacturing were likely to have lower unemployment, but they also were likely to have lower median family incomes. Similarly, counties with higher proportions of their labor force in service industries were likely to have lower median family incomes and higher levels of poverty.

Table 5.3 -- Cross-Sectional Analysis of Three Indicators of County Well-Being in 1980 (N = 706).

Independent Variables	Percent of Labor Force Unemployed	Median Family Income	Level of Poverty
Intercept	8.2077*	27530.0*	10.807*
Average Farm Size	-.000051* (-.705)	-.00300 (-.037)	.00001 (.055)
Quadratic Value (Farm Size)	2.0730* (.555)	N.A.	N.A.
Concentration of small farms	2.2192* (.111)	1508.1 (.065)	-9.1300* (-.184)
Percent Part-Time Farms	-2.3973 (-.093)	7136.2* (.237)	-18.451* (-.288)
Percent Farm of rural population	1.3723 (.035)	-6014.8* (-.132)	4.3066 (.044)
Percent in Manufacturing	-5.4434* (-.227)	-6967.9* (-.250)	4.2257 (.071)
Percent in Service Industries	1.0933 (.018)	-10576.0* (-.158)	20.972* (.147)
Percent of Population Unemployed	N.A.	-545.73* (-.463)	1.2029* (.479)
Proximity to a SMSA	0.2890* (.148)	-713.90* (-.321)	0.9526* (.201)
R2	.207*	.445*	.464*

* = Statistically Significant at .01 level
Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient gives an indication of the relative statistical importance of that particular variable.

A comparison of 1970 and 1980 would suggest that at a minimum, those nonfarm industries most likely to occur in nonmetropolitan counties are not likely to be associated with relatively high levels of county well-being and, in some cases, may have even contributed to lower levels of quality of life. These results further indicate a type of Faustian dilemma for nonmetropolitan counties. While manufacturing employment may keep unemployment levels relatively low, there may be a trade-off with lower levels in median family income and higher levels of poverty.

In both 1970 and 1980, counties that are the farthest away from the economic sphere of influence of an SMSA were more likely to have higher levels of unemployment, lower median family income, and a higher proportion of their families in poverty. In other words, counties that are the most rural are more likely to have the lowest standard of living when these variables are used as indicators.

Table 5.4 presents the analysis of change between 1970 and 1980. Change in farm numbers is unexpectedly positively associated with poverty. While this is a relatively weak relationship, it indicates that as farm numbers decline, so, too, does poverty. Once again, the Goldschmidt hypothesis is not upheld. However, this may be due to the different historical circumstances of Arvin in California, which always had an industrial farm hinterland, and the South where there was more dependence upon tenancy. A decline in farm numbers in the South might indicate the further loss of tenant farms (and possibly outmigration of former tenant families) and, therefore, contribute to a decrease in poverty.

Counties in which average farm size increased the most were likely to have declining levels of unemployment but greater increases in poverty. As with change in farm numbers, both associations are weak, but the latter relationship is the first evidence in support of the Goldschmidt hypothesis. Furthermore, those counties that experienced a substantial decline in their rural population's dependency upon farming also tended to experience increased levels of unemployment and poverty and lower median family incomes. While the association between average farm scale and poverty is relatively weak, it is possible that the unspecified threshold, alluded to by MacCannell and Dolber-Smith (1985), at which further increases in average farm size are associated with decreases in community well-being, may have been reached for the South as a region. This certainly would be consistent with the results of the quadratic equation for unemployment. If so, this would indicate that while concentration in farming between 1969 and 1978 was not highly associated with adverse consequences for community well-being, it may be that the vertex of the inverted "U" has been reached and further farm concentration may be associated with relatively sharp declines in county well-being.

Part-time farming continues to demonstrate a positive influence on county well-being. Those counties experiencing the greatest increases in part-time farming also tended to have substantial increases in median family income and decreases in unemployment.

Table 5.4: Analysis of Change in the Three Indicators of County Well-Being Between 1970 and 1980 (N = 706).

Change for Independent Variables	Change in the Percent of Labor Force Unemployed	Change in Median Family Income	Change in Level of Poverty
Intercept	2.9843* (.000)	7192.2* (.000)	2.0397* (.000)
Farm Numbers	0.0003 (.029)	.4960 (.069)	0.0016* (.074)
Average Farm Size	-.00001* (-.148)	-.0064 (-.091)	.00002* (.102)
Concentration of Small Farms	.07332 (.017)	-0.2577 (-.085)	-5.5952 (-.060)
Percent Part-Farms	-3.9039* (-.100)	3436.0* (.115)	-5.3050 (-.058)
Percent Farm to Rural Population	-6.5441* (-.200)	2864.1* (.128)	-8.1383* (-.118)
Percent in Manufacturing	-.83574* (-.018)	-2204.8 (-.068)	7.1933* (.072)
Percent in Service Industries	3.7240* (.077)	-588.63 (-.018)	3.6843 (.037)
Percent of Population Unemployed	N.A.	-145.51* (-.206)	0.3113* (.144)
Proximity to a SMSA	.17578* (.108)	-45.791 (-.040)	-.2017 (-.058)
1970 Value of Dependent Variable	-.35402* (-.357)	-0.148* (-.280)	-.4364* (-.880)
R2	.176*	.122*	.686*

* = Statistically Significant at .01 level

Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient gives an indication of the relative statistical importance of that particular variable.

With a single exception, change in manufacturing and service employment is not associated with change in county well-being. This exception is the positive association between a greater increase in a county's manufacturing labor force and greater increase in poverty. Once again, this does not bode well for nonmetropolitan counties seeking manufacturing employment.

The 1970 values of each of the dependent variables are also instructive. Counties that had higher levels of unemployment in 1970 were unlikely to have improved much by 1980. Similarly, counties with low levels of median family income were not likely to have improved as much as other counties during the decade. However, those counties with the highest levels of poverty in 1970 were likely to experience the most improvement by 1980.

SECTION 6

Policy Implications of Farm Change for Community Well-Being

The empirical results presented in Section 5 suggest that for the period 1969 through 1980 variables measuring the concentration of farm structure were differentially associated with indicators of county well-being. The strongest association of a farm variable with a measure of county well-being was the quadratic version of average farm scale and unemployment for both 1970 and 1980. This finding suggests that the counties with average farm scale in the medium range were most likely to have low levels of unemployment, while counties with either relatively small or very large scale averages were more likely to have high levels of unemployment. The other farm variables, though, were only weakly associated with the three dependent variables, and in some cases these weak associations were not in the direction hypothesized by Goldschmidt. At the regional level, this would mean that among nonmetropolitan counties in the South, the most recent period of farm concentration did not have the degree of adverse affects on county well- being as might have been hypothesized following the Goldschmidt study. However, there are indications that further concentration may indeed be associated with adverse consequences for nonmetropolitan counties.

Several of the South's agricultural commodities already are characterized by highly concentrated farm structures: rice, cotton, sugar and poultry. It was noted in Section 4 that it is likely that these commodities will become even more concentrated in the future. In Section 5 two sets of findings provide some indication that between 1970 and 1980 counties with relatively concentrated farm structures were associated with negative indicators of county well-being. First, counties with higher levels of unemployment were likely to have either very small or very large average farm scales. Second, those counties experiencing the largest increases in average farm scale were likely to have large increases in the level of poverty. Both findings lend support for the MacCannell and Dolber-Smith inverted U hypothesis. The former finding strongly suggests that counties with highly concentrated farm structures may have a large pool of hired farm workers who are either unemployed or only employed during peak periods of agricultural production. This labor force is likely to be made up of national minority groups, particular blacks and hispanics. Hired farm labor in the U.S. tends to be the least paid and least protected labor group. The later finding was interpreted as possibly indicating that the vertex of the inverted U may have been reached by 1980, and that further farm concentration among southern counties could be associated with greater increases in the level of poverty. Therefore, these finding provide some evidence that further farm concentration may have adverse affects on county well-being.

Aside from the empirical results of this study there is other evidence to suggest that some areas of the nonmetropolitan South will experience further farm concentration, such as the coastal plains of the Atlantic Ocean and Gulf of Mexico. The five studies of this Office of Technology Assessment project suggest that industrial farms are most likely to be found when three conditions occur simultaneously. The first condition is the presence of a highly segmented agricultural labor force. This segmentation usually occurs along sexual, ethnic, and racial divisions. The presence of competing labor groups in the past has been used to keep agricultural wages for hired labors low (see Horan and Tolbert, 1984). Second, the terrain is usually very level. This condition makes it easier to piece together contiguous tracks of land that can then be operated with large labor-saving machines. Third, the economic sub-regions where industrial-type farms have occurred permit the support of large-scale operations.

Not all areas of the South appear to be capable of maintaining industrial-type farms. The mountainous Appalachian and Ozark regions presently do not have a market infrastructure that could support large-scale farming operations, and they certainly do not have the requisite terrain. While the piedmont areas may have the required market structure, the terrain presently does not appear to be suitable, though land extensive operations such as poultry do not need level land. This leaves the coastal regions along the Atlantic Ocean and the Gulf of Mexico. Historically, these regions have had large-scale farming operations, most notably during the antebellum period. Numerous large-scale operations already exist in these areas. Furthermore, this sub-region is characterized by a highly segmented nonmetropolitan labor force (Horan and Tolbert, 1984). There are signs that the present configuration of competing labor groups is expanding to include large numbers of Mexicans and immigrants from Central America. Given the relatively low number of unskilled labor opportunities in the southern nonfarm industries and the degree and character of labor segmentation, a portion of the current nonmetropolitan labor force may be quickly brought into an emerging industrial farm sector.

It is not possible to predict with a great deal of certainty that the coastal regions of the South will experience a rapid increase in farm scale during the coming decades. However, the farm models offered in Appendix C as well as the descriptive data offered in Section 1 suggest that the South will continue to be characterized by continuing concentration in farming. Furthermore, the policy scenarios presented in Section 4 indicate further concentration in all but one of the primary agricultural commodities produced in the South. While it is not possible at this time to predict what type of agricultural commodities other than cotton, rice, sugar, and poultry will be produced by industrial-type farms, horticultural varieties appear to be most likely. In addition, with new labor-saving technologies and the possibility of a radical reorganization of the tobacco program, tobacco farms (especially in the Carolinas) also may become more concentrated. Moreover, technological advances in pest controls may make it more economical to practice large-scale farming where pest levels once were relatively prohibitive. The basis of this qualified prediction is that the conditions under which we now find industrial agriculture in other areas of the nation exist in the coastal areas of the South.

The five regional Office of Technology Assessment studies also provide clues as to county social and economic conditions that may reduce the effects of industrial-type farming. At least four conditions appear to ameliorate the effects of industrial farming. First, for those areas in which welfare benefits and labor laws favor hired workers, especially in agriculture, there is less evidence that farm concentration will adversely affect measures of county well-being. Second, where nonfarm opportunities are available, part-time farming appears to act as a bridge between a marginal existence in farming and a relatively higher standard of living due to off-farm income. The availability of nonfarm employment also may drive up the wages paid by agricultural employers. Third, the skill level of the local population is relatively high in areas where farm change has not been associated with a decline in county well-being. Fourth, these areas are also characterized by relatively low ethnic diversity among the unskilled labor force, though sexual and class segmentation does occur.

Generally, the conditions listed above are weak among nonmetropolitan counties in the South, especially among many of the coastal and delta counties. If further concentration of farming in the South is negatively associated with county well-being and, especially, if there is a rapid industrialization of farm structure in the coastal and delta areas, the communities affected by these trends could experience the types of social and economic problems described by MacCannell and Dolber-Smith (1985) for the industrial agricultural regions in California, Arizona, Texas, and Florida. However, once again it is necessary to caution the reader that these predictions are based on three assumptions. First, the South as a region may have reached the vortex of the inverted "U" described by MacCannel and Dolber-Smith, and further concentration will adversely affect county well-being. Second, the conditions under which industrial farming now occur presently exist in the coastal areas of the South: therefore, while there are now no strong indications of rapid industrialization, the conditions may exist for such industrialization. Third, the conditions thought to soften any adverse consequences of further farm concentration are weak in the South.

The empirical findings, then, offer some support for the notion that further concentration in the South will significantly hurt nonmetropolitan county well-being. However, there is evidence that high or increasing levels of part-time farming may be positively associated with indicators of county well-being. Furthermore, part-time farming may be a function of both hard times in farming and the availability of the nonfarm economy's influence on farm structure, i.e., levels of part-time farming.

The Empirical Association of Farm Change with County Well-Being

The various scenarios for the six primary agricultural commodities raised in the South (discussed in Section 4) suggest continued, perhaps even accelerated, concentration of farm structure for most commodities. The analysis does not indicate that further concentration, at least at the aggregate regional level, will improve county well-being, but it may facilitate a decline in well-being.

At the regional level, these findings do not confirm the Goldshmidt hypothesis that increased farm concentration will automatically adversely affect county social and economic well-being. This does not, however, represent a rejection of the Goldschmidt hypothesis as much as it suggests important modifications. These would include the types of cultural, ecological, economic, and labor force conditions that are most often adversely associated with industrial farming as well as conditions that mollify the impacts of further concentration. It would also include a caveat pertaining to the association of small scale farming with community well-being. It should be recalled that Goss (1979) found the Dinuba hinterland (Goldschmidt's so-called family farm community) to be made up of medium sized farms, rather than the classic small scale family farm. Our study suggests that small scale farms are associated with higher levels of unemployment. While this finding may be unique to the South and its history of tenancy and sharecropping, nonetheless, it does provide evidence that small scale farming is not uniformly associated with positive indicators of community well-being.

The findings do suggest that levels of part-time farming are associated with county well-being. Those counties with high levels of part-time farming in 1969 and 1978 were more likely to have lower levels of poverty and higher levels of median family income. Furthermore, counties with the most rapid increase in the proportion of operators working 100 or more days off of the farm were more likely to have had a faster rate of decline in unemployment and poverty, while increasing faster in median family income.

However, these findings should not be interpreted as indicating the move into part-time farming is desired by farmers, or that it is unstressful. Coughenour, et al. (1984) found that Kentucky part-time farmers generally did not like their off-farm work as much as farming and were hoping to return to full-time farming. Nor should part-time farming be considered a stable form of farming. The economic conditions that forced many part-time farmers and their family members to seek off-farm work could eventually force them out of farming altogether. Also, holding down two jobs can be quite stressful. In addition, when farmers move into nonfarm jobs, they will be competing with unemployed or underemployed nonfarm labor for scarce employment opportunities.

Part-time farming requires the presence of nearby nonfarm employment opportunities. Bonanno (1985) suggests that part-time farming may have an informal welfare function for both farmers and marginal nonfarm enterprises located in nonmetropolitan counties. For farmers, it offers a way for many former full-time farmers to stay in farming, albeit usually on a smaller scale (see Coughenour and Swanson, 1983; Deseran, et al. 1984). For highly competitive nonfarm enterprises on the peripheral of the national economy that must constantly adjust their labor requirements in reaction to macroeconomic changes, part-time farmers represent a reliable pool of labor, since they are less likely to migrate during hard times.

Conceptually, the need for nearby nonfarm employment opportunities indicates that the nonfarm sector can have as much, if not more, of an influence on farming as can the farm sector. This observation also reinforces the conceptual framework of regional change offered in Section 2 and Appendix A that changes in the nonfarm economy may have more demonstrable impacts on community well-being than do changes in the agricultural economy.

The Influence of Nonfarm Factors on County Well-Being

The most intriguing findings are the influences of nonfarm factors upon county well being. Indeed, while the Goldschmidt hypothesis does not receive a great deal of support in linear analysis, if the Goldschmidt hypothesis is applied to the industrialization of the nonfarm sector, then there is a considerable amount of empirical support. Of particular interest are the associations of the percent of the county's labor force in either manufacturing or service industries on measures of well-being.

The level of employment in manufacturing is negatively associated with levels of unemployment for both points in time and for change between 1970 and 1980. This indicates that manufacturing industries may help keep levels of unemployment to a minimum. However, manufacturing employment is negatively associated with median family income in 1980, suggesting that the higher the levels of manufacturing employment, the lower the levels of median family income.

Somewhat similarly, the level of employment in service industries is negatively associated with median family income and positively related to poverty in both 1970 and 1980. This indicates that where levels of service industry employment were high, median family income was lower while levels of poverty were higher.

Both sets of findings might be cause for concern since they suggest a modern Faustian dilemma for nonmetropolitan counties in the South. Both manufacturing and service industries have been moving into these types of counties in recent years (Bluestone and Harrison, 1982; Horan and Tolbert, 1984). The labor forces of these two types of enterprises are often low- wage and unorganized. Furthermore, nonmetropolitan counties have often made considerable financial sacrifices to attract these types of industries (Horan and Tolbert, 1984; Summers, 1979; Summers, Evans, Clemente, Beck, and Minkoff, 1976). The findings indicate that while manufacturing is associated with lower levels of unemployment, those counties experiencing the largest increases in manufacturing employment are also likely to have experienced either a lower rate of decline in poverty or even increases in poverty, while the region as a whole dropped in poverty by approximately 7 percent between 1970 and 1980. The case of service industries is even more suspect. Therefore, many of the industries that have left the so-called "rust belt" for the South may present disadvantages for both regions.

As with the influence of farm change, these findings for manufacturing and service industries have been considered at the regional level. Not all manufacturing and service employment will be adversely associated with either median family income or the percent of families in poverty. Furthermore, there may be considerable difference among the subregions of the nonmetropolitan South that would make these findings conditional. However, as with the farm indicators, these two nonfarm employment indicators do articulate regional associations.

Another but more predictable nonfarm factor is proximity to a metropolitan area. This measure is intended to estimate how both geographical and socioeconomic distance from a metropolitan area would influence county well-being. Unsurprisingly, the more isolated a county the more likely it will have higher levels of unemployment and poverty and lower levels of median family income. Furthermore, those counties farthest away are more likely to be the first hurt during the onset of an economic downturn, and they are likely to be the last to benefit from economic recovery.

Cautions Concerning the Empirical Results

Some of the policy implications presented here are based upon the empirical results. Several caveats noted in earlier sections are worthy of restatement.

First, it is possible for the Goldschmidt hypothesis to be useful in anticipating social dislocation or a decline in well-being of specific individuals in a community due to the increased concentration of farm structure without having the entire community being affected similarly. Second, the unit of analysis of the empirical research is the county and not a set of communities. It is very likely that communities vary considerably in their dependency on farming within a county such that some are more likely to be adversely affected by continued farm concentration than others. However, at an aggregate county level, such variation may be suppressed due to the overwhelming nonfarm character of the counties' social organizational structure. Third, the analysis reported in Section Four is for all of the nonmetropolitan counties in the region. As with the variation of communities within a county, so, too, the empirical results may not hold for individual counties. Given the economic, social, and geographical diversity of the region under study, such internal variation is likely.

That these cautionary statements are included is not due only to academic convention. The creation and analysis of economic and sociological models should not be considered a mystical process that produces a clear image of societal reality. Rather, they can be of great use if their inherent biases, both conceptual and methodological, are kept in mind during the interpretive process. This is all the more true with the farm and community analysis reported here. While our findings are consistent with the conceptual framework that farm change may not be as important for community well-being at the regional level (for 1969-1980) as it was during earlier historical periods, nonetheless, continued farm concentration may have considerable adverse consequences for subgroups within the region and even within counties.

A potential exception might be those communities that have a considerable degree of dependency upon tobacco farming. Presently, tobacco farming is still a relatively small-scale operation. This is directly the consequence of federal tobacco policy, which not only includes a price support program but also continues to place restrictions on total production (i.e., through a quota system). In the past, the combination of both price supports and production controls has reduced incentives for labor-saving technologies, though not for land-saving technologies. Furthermore, since the present production process relies upon casual nonfamily labor, the multiplier effect of the wealth created is not only defused among a large number of farm families but also among the nonfamily labor. Should these programs be eliminated, as has been proposed, most of the traditional barriers to larger farm scale will be eliminated as well. Tobacco harvesters have been developed and continue to be modified. Should the programs be removed, then there will be greater incentives to expand productivity while holding labor constant. Such incentives will make large-scale farms more probable and make the use of labor-saving technologies necessary. With fewer farms and fewer hired laborers producing the commodity, it seems reasonable to assume that the multiplier effect will be less than it is now. In addition, land values that were artificially high due to production limitations will be deflated. This could reduce the sum of the local revenue based upon the value of land. Finally, it is not at all certain that most of the small farms presently producing tobacco will be able to compete with larger scale operations under relatively competitive market conditions. The potential loss of income for individuals may be considerable, yet at a regional or even subregional level, these potential changes in farm structure may not record statistically significant negative associations with county well-being.

SECTION 7

Conclusions and Policy Recommendations

Since the early years of commercial farming, the marketplace has presented incentives for the development of agricultural technologies that would save scarce labor, land, and capital resources. This trend is not likely to end in the near future. However, the types of technologies that will facilitate further concentration may be different. Whereas the labor-saving technologies of the nineteenth and mid-twentieth century greatly contributed to farmers' ability to expand their farms' scale, these technologies may not have as decisive a role during the next twenty-five years. Instead, technologies that enhance management efficiency or resource saving technologies such as the constellation of biotechnologies that can increase production without necessarily altering the capital to labor ratio may be as important, if not more important. However, while the types of technology may be different, their utility will continue to be in helping a farm manager to improve the firm's position within the market place by expanding total production and/or reducing the cost of production.

The farm structure analysis presented in Appendix C provides considerable evidence that both land- and labor-saving technologies were important factors contributing to farm concentration in the South between 1969 and 1978. However, it is necessary to reiterated that it is not the development of technologies that drives farmers to maximize their profits, but it is the need to maximize their profits that induces farmers to adopt technology in order to remain competitive. Those who control the development of these technologies not only will determine the use of scarce research resources, but will wield a great deal of power in the agricultural economy (see Busch and Lacy, 1983; Buttel, Kenny, and Klopenberg, 1985).

The new generation of agricultural technologies will be more management intensive. Given the relatively poor rural education system in the South and the lower levels of education achieved by southern farmers as compared with the rest of the country, these new technologies may not be used by a wide range of small producers. Furthermore, these new technologies may alter the farm workplace since their utility often will require a higher division of labor or greater dependency upon contract specialists.

It is difficult to imagine any scenario under present political and market conditions that will stop, much less reverse, the trend toward a more concentrated farm structure in the South, short of another great depression or massive federal intervention. Much has been said about the apparent bimodal tendencies of farm structure. However, some caution in interpreting this structural phenomenon is prudent. When only commercial farms (i.e., farms with a minimum of $40,000 in gross sales) are considered, the bimodal trend is less apparent. Small to medium commercial farms (approximately from $40,000 to $250,000 in gross sales) are usually the ill-fated farm group that is said to be the "disappearing middle." But when these are acknowledged to be the lower end of the commercial farm scale, their disappearance should be considered as evidence of concentration, not bifurcation.

Farms of less than $40,000 in gross sales tend to be characterized by a dependence upon off-farm income. Of the farms within this sales category in 1979, 63.4 percent of the family's income was earned off of the farm. Kada (1980) provides evidence of many new entrants into farming who have little intent of operating a commercial farm. Therefore, the growth among small farms that is implied in the bifurcation of American farming, is in actuality only a bimodal phenomenon if small part-time operations are included. Few farms in this group can subsist on income from farming alone. This observation does not trivialize the dire plight of former full-time commercial farmers who have sought off-farm employment to support sagging farm income. Instead, their fate should be considered evidence of the marginalization of America's small farms rather than evidence of their vitality.

Federal farm policies also have had important differential influences among American farms. In Section 2 it was proposed that price-support programs tend to encourage the concentration of farm structure among the largest farms while slowing the decline among the smallest part-time farmers. Consequently, the price support system appears to have been one of several factors facilitating the concentration process among large commercial farms while providing some limited support for small farms. Supply control programs that establish quotas which are traded with parcels of land such as in tobacco, may contribute to the persistence of small scale farming. Any estimation of how farm change will influence community well-being would have to include the potential for change in federal farm policy, especially the termination of both price-support and supply-control programs. If price supports were eliminated, the rate of concentration among the largest farms would be diminished: however, the loss of smaller family farms might be accelerated. Among those southern states with substantial tobacco production, the elimination of the allotment system is likely to create new incentives for technological innovation for labor- saving machines and possibly land-saving inputs. Once such technologies are available, there would be market incentives for the acceleration of the concentration of tobacco production.

Federal farm policy will only determine the rate of concentration. Whether or not the South's farm structure continues along the present trend toward a dual structure is unclear. Commodities such as cotton, rice, sugar, and poultry are already concentrated and the smaller producers of the commodities will have a difficult time competing with the very large farms. Both beef and tobacco production are expected to move from primarily small operations into medium sized farms. This represents a break with the more general trend toward a bimodal farm structure. Dairy farms are expected to move from medium to large-scale operations. Only grain production is expected to move toward both smaller and larger farms, with the middle sized farms disappearing. Finally, conditions appear to exist for the further industrialization of the South's coastal areas.

The continued concentration of farm structure, facilitated by technology but the consequence of market conditions, may have a negative impact on the social and economic well-being of the rural population. The empirical analysis suggests qualified support of the Goldschmidt hypothesis. If our prognostication of the consequence of further concentration of farming on the rural population were to be based solely upon the models and time period of the empirical analysis, then we would have to report that at the regional level a continuation of farm concentration will not have a universal negative impact upon the well-being of southern nonmetropolitan counties, with the clear exception of unemployment.

The evidence in support of the MacCannel and Dolber-Smith hypothesis could indicate that as a region, further concentration in farm structure would be adversely associated with community well-being. In addition, it has been noted that the conditions that characterize industrial-type farming elsewhere (especially as described in the MacCannel and Dolber-Smith paper) appear to exist in the coastal areas of the South. Since this study could not directly assess how incidences of industrial-type farming may affect community well-being, the MacCannell and Dolber-Smith conclusions resulting from a close examination of counties with a high degree of industrial farming are instructive. Their general conclusion is that industrial farms are associated with some of the worst poverty in America. Therefore, if the coastal areas were to experience movement toward an industrial type of farm structure, then on the basis of the MacCannell and Dolber-Smith study, we conclude that county well-being will be adversely affected. Presently these areas generally do not have the types of economic and social amenities that could counter the potential negative impact of an industrial farm hinterland.

The empirical results do support the notion that nonfarm industrialization may not improve the social and economic well-being of the South's nonmetropolitan counties. Historically, the nonmetropolitan South has been on the fringe of national prosperity. This region tends to attract peripheral industries located in highly competitive markets and characterized by low-wages and little organization of the labor force. The most recent surge in southern rural industrialization lessened county dependence upon agriculture. Indeed, a county's nonfarm employment structure may have the affect of reducing the rate at which marginal farms go out of production by offering off-farm opportunities to support limited farm incomes.

This study provides evidence in support of Bonanno's assumption that part-time farming may serve as a welfare function for both the farm families and peripheral nonfarm industries located in nonmetropolitan counties. Goldschmidt failed to consider how the regional economy may influence farm structure, but the findings suggest that the regional economy can influence farm structure by providing the opportunity for one or more members of the farm family to earn off-farm income.

Among the indicators included in the various models of county well- being, the most interesting associations are those of manufacturing and service industry employment. These findings suggest that nonmetropolitan counties should select nonfarm industries with care. These findings also underscore the continuing need for a comprehensive rural/nonmetropolitan development strategy for the South. The nonmetropolitan South has lagged in economic and social development. Much of this may be due to the enduring effects of the nineteenth and early twentieth century farm and industrial conditions discussed in Section 3 and Appendix B. If these counties continue to attract only peripheral industries, it is unlikely that they will improve their quality of life with only their own scarce resources.

Two additional points of caution are necessary. First, all of the policies discussed and analyzed are federal. No attempt has been made to assess the potential impact of state and local policies. Yet, such policies can have significant affects on both farm structure and community well-being. Furthermore, no mention has been made of nonproductive policies, at any level of government, such as soil and water conservation. However, the success of such policies can be, and often are, highly dependent upon production policies.

Farm Policy and Farm Structure

On the assumption that further concentration may cause a decline in county economic and social well-being, farm policies that retard concentration may provide a brief buffer during which counties and their rural communities adjust to the potential changes. To enhance the adjustment process, farm policy should help the medium sized farms (gross sales of $40,000 to $250,000) stay in production while providing disincentives for further concentration of the very largest farms (gross sales of $500,000 or more). In Section 2 we discussed the ways in which different farm policies either encourage or hamper the process of farm concentration. It was noted that price support programs tend to facilitate, indeed encourage, concentration while at the same time helping the smallest farms to remain in production. The elimination of the price support system, while possibly reducing the rate of concentration among the very largest farms, would probably accelerate the loss of medium-sized and small farms. Therefore, a course needs to be charted between present price support policies and the elimination of price support programs.

Tobacco, cash grains, and cotton are the primary commodities that will be impacted by a transitional price support policy. Given the current financial stress of farmers, a rapid elimination of price support programs would cause a major restructuring of farms in the South. Yet, a continuation of current programs will likely reinforce current bimodal trends identified in this study. Current programs, which to a large extent, ignore international markets will need to be accompanied by supply control policies. Thus, existing farmers who have established production and who, therefore, qualify for these programs will reap not only the short run benefits from the price and income support mechanism, but also the long run benefits as short run benefits are bid into asset values (primarily land). Such a market process will led to concentration of the largest farms. This suggest two important transitional program changes: 1) price support levels must be tied to world markets, and 2) payment limitations need to be carefully designed so as to target benefits to mid-sized farms. Previous attempts to accomplish these objectives attest to the difficulties. Yet, these objectives are essential to a transitional price support policy which will allow for the least disruptive adjustment process to Southern farm structure.

Another arena of federal policy that has influenced the bimodal distribution in farm structure is taxation. Shelters provided by capital gains taxes and inheritance taxes have encouraged an increase in outside investment, and in part have been responsible for the increase in small farms with a dependency on off-farm income. Likewise, the present tax system has inherent incentives for capital investments (including the purchase of land) which have facilitated concentration among the very largest farms. Consequently, tax policy modifications should be developed with the intent of assisting the mid-sized commercial farms without providing new incentives for non-farm investment in small farms or new incentives for the largest farms to expand.

A number of tax policy changes merit consideration. First, changes in items that are eligible for capital gains taxation may be in order. For example, investment in beef production by small farms is likely a function of the capital gains provisions which allow sale of breeding stock to be taxed at considerably lower levels. Results from Section 5 suggest that such small farms do not make a strong contribution to the economic well- being of rural communities. Indeed, an argument can be made that these tax laws have caused inefficient use of southern agricultural resources. Since many of these small farms may be producing beef as a tax shelter, they are likely bidding resources away from mid-sized commercial farms. Another change that may be in order relates to inheritance laws. Wealthy individual who desire to leave a larger proportion of their wealth to their heirs are attracted to land investment by these laws. New or more rigorous laws need to be developed to guard against these types of investors. Finally, some consideration of limitations on tax write-off benefits may be in order, if there is a desire to slow the concentration of the very largest farms. For example, a limitation on interest write-offs would discourage debt financed expansion beyond certain levels. Also, a limit on the amount of farm investment tax credit could have a similar impact. Each of these taxes changes would need to be carefully designed with the broader objective of assisting mid-sized commercial farms in mind. This recommendation should not be interpreted as dismissing the importance of small part-time (usually subcommercial) farms. Rather, these farms may be better served by an aggressive rural development policy that facilitates the development of nonfarm opportunities at a livable wage.

One final policy that merits further analysis is a negative income tax. If the objective is to target benefits of government transfers to mid-sized farms, a negative income tax offers some distinct advantages. It would be possible to monitor farm and non-farm earnings with a negative income tax. Decision rules could be carefully designed to provide a negative income tax to only those farmers with a certain proportion of farm income. Also, the tax forms could be used to sort out large farms that were clearly showing a low income (which may qualify for a negative income tax payment) due to expansion versus mid-sized farms that have occasional low incomes because of market forces. Clearly, very carefully thought would need to be given to design of a negative income tax for mid-sized farms. Many possibilities for abuse would exist. For example, cash accounting would provide farmers the opportunity to manage inventories in such a fashion that they could show a low income every other year. Yet, despite these potential problems, a negative income tax could be designed in such a way that would provide efficient transfer of government payments to a targeted group of farms.

The Need For A Comprehensive Rural Development Program

Nonmetropolitan counties in the South show no signs of joining in the national prosperity as full partners. The legacy of uneven development is captured in a startling statistic. In 1979 over ninety percent of the U.S. nonmetropolitan counties considered to have persistently low incomes (PLI) were located in the South (Thigpen, 1984). There is a chronic need for a comprehensive rural development program in this region. In recent years it has been vogue to let the marketplace mediate economic development. There is no evidence at the regional level that such a policy will contribute to an improvement in social and economic well-being. On the contrary, this report suggests that such a laissez faire development policy will only reinforce past patterns of under-development. The type of manufacturing and service industries that acted as the bulwark of a laissez faire rural development policy during the period of 1970 through 1980 were associated with high levels of poverty and low levels of median family income. It is not enough to simply provide employment. Such employment must improve the well-being of workers and through multiplier affects contribute to improved community services.

The economic fortunes of the nonmetropolitan South are tied to its position in the national and international economy. Given the relatively poor position of this region in the national economy it is not reasonable to expect these areas to improve their social and economic conditions with their own resources. In a series of monographs, leading Rural Sociologists and Agricultural Economists have persuasively and forcefully argued for a comprehensive rural development program (Bradshaw and Blakely, 1983; Dillman, 1983; Wilkinson, Hobbs, and Christenson, 1983; Wilkinson, 1984). The initial premise of their arguments is that nonmetropolitan areas are presently experiencing extreme social and economic problems. Wilkinson (1984:349) has bluntly stated that "the rural economy is highly unstable today." The dire social consequences of these depressed conditions and the persistence of social inequalities include "intolerably high rates of infant mortality and homicide. . . inadequate jobs and income, inadequate services" and a decline in effective grass roots self-help initiatives (Wilkinson, 1984:350-51). While it is popular and correct to provide aid for hunger and underdevelopment abroad, it is unconscionable to ignore the consequences of poverty at home.

There appears to be a consensus among these specialists in rural affairs concerning the character of a national rural development program. Such a program would require a "two-fold attack, one that combines federal initiatives with local initiatives -- the former to increase resources, the latter to build a sense of community" (Wilkinson, 1984:351). Four general criteria are usually given. First and foremost, there must be a program aimed at the creation of jobs that generate a livable income. "A strategy that does not start with jobs simply does not start" (Wilkinson 1984:349). The federal government must provide capital and incentives for the development of industries that are not likely to exploit rural labor. Such a package should be accompanied by labor laws that protect unorganized labor from unfair practices by industry. In particular, civil rights laws that reduce the effects of racism, that often is associated with highly segmented labor forces, need to be revised and enforced. Without such laws and their enforcement, disenfranchised segments of the unskilled and semi-skilled nonmetropolitan labor force can be played off against one another, thus forcing wages down.

The second dimension addresses the unique spatial problems of less densely populated areas. In addition to the economic problems of low income and under employment, rural service structures essential to the persistence of an industrial labor force, such as health services and education, as well as infrastructure services such as water, sewer, and electricity, tend to be more expensive on a per capita basis. Wilkinson (1984:350) describes this dilemma as follows:

> A development strategy that ends with jobs and income, however, ends. Much more will be needed to redress the gross inadequacies in rural infrastructure and to improve social well-being in small towns and rural areas. The need for improved services in rural areas has reached, in my estimation, a crisis stage. Space, low population density, and high levels of poverty combine to deny adequate levels of health care, child care, education, and related services to many rural Americans. . . Rural communities in a period of austerity face severe problems in providing police and fire protection, sewage treatment and disposal, and virtually the full range of other public services.

The third dimension of a rural development program is the recognition that under these poor social and economic conditions, not all rural people have access to even these limited services. As with the proposed strengthening and enforcement of labor laws, a rural development strategy must include programs that aid all rural citizens to take advantage of local services necessary for the minimum levels of decency expected in the U.S. The rural South is characterized by several ethnic and racial groups that historically have been left behind in national development.

The fourth dimension addresses the need for local participation in any type of rural development program. The problems of inadequate jobs and income, inadequate services, and inequality pose a crisis of community in rural America (Wilkinson, 1984:351). These three conditions tend to discourage a shared sense of identity in rural communities, and consequently reduce the occurrence of volunteer efforts and the development and maintenance of self-help networks. By improving the employment opportunities and service structure of the South's nonmetropolitan counties while at the same time removing the legal barriers to equal access of the benefits offered by our society, the conditions that presently suppress grass-roots efforts can be overcome. Such local initiatives are necessary for rural development effort to garner what scarce human and economic resources that can facilitate the drive for a better life. Rural areas cannot handle the task of economic and social development on their own. Federal, state, and local initiatives are necessary. The first step must occur at the federal level, and it must be directed at job creation, service structure support, and the enforcement of civil rights and labor laws.

Any national rural development program must be coordinated. Winkler (1984) announced that a new government-wide rural development policy has been formulated. This report recommends that all federal agencies consider the impact of their programs on rural areas, and where appropriate add a rural development specialist to their staff. However, any major rural development effort should be coordinated by the Department of Agriculture.

APPENDIX A

Historical Background of Southern Agriculture and Rural Communities

The economic and social history of the south is characterized by radical economic and social upheaval. The legacy of the antebellum period still persists in subtle forms, particularly in the structure of agriculture and rural community social organization. It is impossible to discuss future changes in farming and community well-being without first assessing how the South's unique history has contributed the present situation. However, in the century after the Civil War, the South's agricultural and rural nonfarm industries increasingly have been shaped by the same forces of rationalization that have produced the phenomena of the industrial revolution and urbanization. Consequently, the rural South today reflects both the legacy of the antebellum period and the social and economic organization of an advanced capitalist society.

Three types of social formations dominated Southern agricultural production during the antebellum period: (1) slavery and the plantation system, (2) commercial family farming, and (3) subsistence family farming. Each of these agricultural production systems had a distinctive association with production technologies, the quality and structure of local society, and market orientation. Any discussion of the present relationships among agricultural technology, farm structure, and rural communities must necessarily include the character and transitions of these historical conditions.

Southern society has been characterized by a dependency upon agricultural production. However, the types of commodities produced, the variety of social and economic relationships used to produce agricultural commodities, and their distinctive market structures have been associated with relatively unique types of local societies. All three types of agricultural production systems of the antebellum period have left their impression on the present structure of Southern rural society. The social and economic character of each of these systems is briefly reviewed in order to place the present structure of Southern rural society within a historical framework.

Slavery and the Plantation System

The plantation system and the coercive bondage of slave labor is rooted in the colonial period when land was abundant and labor scarce. Large agricultural production units found more security in using slave or bonded labor than freeman hired labor that could leave at any time. Given the labor intensive requirements of the agricultural commodities being produced, control over the labor force was seen as essential to the persistence of large scale production units. Plantations, while producing some commodities for their own consumption, were primarily oriented toward commercial production. Hahn (1983: 4) has noted that:

> Without question, cotton production decisively linked the region to national and world markets and fueled the burgeoning industrial revolution in the North and Europe. Yet the staple owed its vitality to slave, not free, labor and its soil was ruled by an elite increasingly scornful of bourgeois relations and values.

The plantation system, then, was a highly stratified social and economic institution that was very dependent upon slave labor and world markets.

The use of slave labor had many irrational tendencies that inhibited the economic development of the South and undermined social stability (Genovese, 1965: 16) Genovese (1965), Weber (1947), and other scholars who have examined slavery identify at least four important irrational features that eventually undermined its economic viability and social legitimacy. First, plantation owners could not easily alter the size of their captive labor forces in order to adjust to changing market conditions. Consequently, economic efficiency could not be attained by frequent reorganization of the labor force. Second, "the capital outlay [was] much greater and riskier for slave labor than for free labor (Genovese, 1965: 16). Third, "the domination of society by a planter class [increased] the risk of political influence in the market" (Genovese, 1965: 16). Fourth, cheap labor was often scarce or unavailable. As a result, at a certain economic threshold, slave labor became very expensive (Genovese, 1965: Chapter 1; Weber, 1947).

Furthermore, unlike the emerging capitalist economy which demonstrated a remarkable ability to react to the pressures of competitive markets, plantation owners could not react effectively to changing market conditions and tended not to reinvest a greater part of their profits in their production systems. The customs and status roles of the plantation class were characterized by high consumption of non-production goods. Such consumption provided a visible confirmation of the plantation class's economic and social domination, but had the contradictory effect of diverting scarce capital from the production process.

The plantation system was also characterized by an underutilization of efficient production technologies. In particular, the crude production technologies that were used were of poor quality. Three factors contributed to this poor performance in adjusting to technological change. First, because significant proportions of the profits were diverted to non- production commodities there often was not enough capital left over to invest in production technologies. Second, the slaves often showed their resistance to their social position by deliberately destroying or disabling tools. Third, because of the low demand for high quality labor-saving technologies, and because of the low demand for such production technologies by commercial family farmers (given their relative low accumulation of capital to invest), the South did not develop an economically viable manufacturing sector that could supply such technologies.

This last factor is of particular significance for the slow industrialization of the South (see Genovese, 1965: Part Three). The inability to develop "home" or "regional" markets for manufactured goods is considered to have contributed to the South's loss of the Civil War, since prior to the war the antebellum South was dependent upon the North and Europe for cheap and quality manufactured goods. This dependence was directly associated with the irrational characteristics of the plantation system.

> The North rose on the rapid expansion of the rural market, whereas the South remained dominated by slave plantations until the [North], interested in a new system of rural exploitation imposed a reorganization from without. An adequate home market could not grow in the antebellum South and has evolved slowly and painfully during the last century (Genovese, 1965: 159).

Prior to the Civil War in the North and Midwest, commercial family farmers provided a large market for labor-saving production technologies that accelerated both agricultural and industrial development. Manufacturing in the North increased on the basis of this almost insatiable demand. In the South, the internal market for manufactured goods "consisted primarily of plantations, which bought foodstuffs from the West and manufactured goods from the East" (Genovese, 1965: 165). Furthermore, the Plantation class was not eager to see the rise of a capitalist class or of commercial family farms, which it correctly perceived to pose a threat to its economic, political, and social domination (Genovese, 1965: Part Three; Hahn, 1983).

While it was not in the Plantation class's interest to encourage the emergence of potential economic competitors, the long-term effect was to place the South at a distinct disadvantage once it entered the industrial revolution. The antebellum South on the one hand provided one of many markets for Northern and European manufacturers, yet, on the other hand, did not have enough internal demand to adequately support an indigenous manufacturing sector. As the antislavery Kentuckian Cassius M. Clay remarked "A home market cannot exist in a slave state" (Genovese, 1965: 173).

The plantation system, then, was based upon slave labor which restricted its ability to adjust to changing market conditions, and was characterized by a plantation elite who, rather than plowing most of their profits into production, chose the path of conspicuous consumption as a symbol of their domination. The destruction of the plantation system after the Civil War created a large group of landless black laborers, which was critical to the emergence of a new farm structure based upon racial social relations and economic dependency - sharecropping (Mandle, 1978). But, perhaps the most important legacies of the antebellum period for current circumstances were the plantation class's ability (1) to retard the development of internal markets, (2) restrict the rise of a capitalist class and a skilled industrial labor force, and (3) thwart the expansion of commercial family farms.

Commercial and Subsistence Family Farms During the Antebellum Period

Commercial and subsistence family farms formed the remainder of the agricultural sector during the antebellum period. Their total population greatly exceed the plantation population, including slaves. Yet, together these two farm structures had little in the way of economic and political power (Billings, 1979; Hahn 1983). Both of these farm production systems were dependent upon family labor supported by community cooperation. Most of these yeoman farms did not fit neatly into these ideal categories, but were situated somewhere in between, following the logic of both subsistence and commercial farming systems. The principle differences were in the ways in which each organized the family labor process, employed the powers of technology, and depended upon the market for their persistence.

Subsistence family farms primarily produced for local consumption. The persistence of these farm families, and their local societies, depended upon the ability to produce a wide variety of commodities other than commercial agricultural goods. Family labor, then, was organized to produce multiple commodities. The technologies that were employed tended to be made locally from available resources. The most common form of tillage system was a wooden plow pulled by a team of oxen. Commercial family farm labor was organized to produce only a few agricultural commodities, relying upon their earnings in the marketplace to purchase most of their non-agricultural commodity needs. These farms tended to rely upon labor-saving technologies that permitted them to cultivate and harvest a greater number of acres. Unlike subsistence family farms, commercial family farms were more likely to use an iron-tipped or steel plow pulled by draft horses. Furthermore, commercial family farms were dependent upon their performance in the marketplace for their continued production.

Family farms often were characterized by both subsistence and commercial farming strategies, depending upon their proximity to non-local markets, and their capital and labor resources. The world of the Southern yeoman farm family:

> was one in which production and consumption focused on the household, in which kinship rather than the marketplace mediated most productive relations, in which general farming prevailed and family self-sufficiency provided the fundamental concern, and in which networks of exchange proliferated ... Providing for the short- and long-term independence of the family governed the logic of this system, and the household economy rested at the heart of the undertaking. (Hahn, 1983: 20).

If self-sufficiency was the norm, it was equally apparent that such self- sufficiency was not confined to the household. "Most up-country yeoman participated in a market, but one decidedly local in character and regulated by custom" (Hahn, 1983: 33).

These farm families were characterized by considerable but by no means rigid internal stratification based upon property ownership, gender, and age. The men primarily were responsible for field work, though the women often joined in the labors of the harvest. "Complementing the labors of the men, women played a pivotal role in assuring that the household produced much of what was consumed" (Hahn 1983: 30). Relationships among family members were mediated by the dominant male:

> In the patriarchal household economy, relations of legal and customary dependency, not equality, linked all to the male head. Women could not vote and surrendered rights of property to their husbands upon marriage (Hahn, 1983: 31).

Local societies tended to involve a significant community-help network, from which the notion of "community" has emerged. Such community efforts, though, were not based upon innate altruism, but upon the necessities of survival under conditions of both labor and resource scarcity. Consequently, instead of an egalitarian society, these local societies tended to reflect household social stratification. Community power rested in the hands of older white males with property. Free blacks and slaves, while not ostracized, were none-the-less segregated. Blacks lived in separate buildings on family farms, and generally formed subcommunities within local society. Consequently, black economic dependency and social segregation was the norm in both the plantation "Black Belt" and the yeoman farm society. This legacy of racial segregation along economic, social, and political lines continues to shape rural Southern Society.

The economic and social subordination of family farmers to the plantation system in great part was due to their inability to accumulate enough wealth to establish regional markets and political power on their own. The economic logic of these farming systems did not involve an entrepreneurial spirit as it is conceived of today (Henretta, 1978). The development of economic ties with regional markets primarily was seen as the responsibility of the state.

The Rural South's Transition to a Modern Society

The Civil War wrecked internal communications and transportation facilities and radically altered the agricultural structure. Furthermore, the emergence of an industrial economy was very uneven. In agriculture, two transitions stand out: (1) the replacement of the plantation system by sharecropping, and eventually large-scale industrial-type farms, and (2) the eclipse of subsistence family farming and the rise of tenant and full- owner commercial family farms and eventually larger-than-family farms.

The Civil War did not end the economic and political power of the former plantation class.

> Plantations do not reflect the entire southern rural experience, ante- or postbellum; but they have ever been the

> focus of economic power and the vanguard of change. Twentieth-century planters, probably more so than their predecessors, were landlords, bosses, and creditors to many times their numbers. They organized and dominated much of the flatland and hill South (Kirby, 1983: 257).

The cotton plantations of the South tended to be subdivided into small holdings on which primarily emancipated black labor worked the land. However, these black families did not own the land, used production technologies supplied by the landlords, did not make either annual or daily management decisions, and were paid on the basis of a share of the crop (Mann, 1984). Furthermore, these black families were securely tied to the credit systems established by the landlords (see Pryor, 1982).

In contrast to the cotton plantations, the sugar cane plantations remained relatively in tact through the use of labor gangs. Shlomowitz (1984) has attributed these two historically divergent responses to the demise of the antebellum period in terms of each crop's unique production and market characteristics. Shlomowitz (1984: 14) argues that:

> the primary advantage that the plantation mode of organization had in the farming of sugar cane were in reducing the transaction costs in the coordination of harvesting and milling, in reducing the costs of measuring the sucrose supplies of cut cane to be milled. The primary advantages that the smallholding mode of organization had in the farming of cotton were in the making fuller use of the labor of women and children and allowing for the close personal attention that only the small holder would have an incentive to give.

However, the great majority of plantations produced cotton, and as a result, sharecropping become the primary social formation to emerge in cotton production.

Sharecropping as the primary type of farm organization producing cotton lasted only for three-quarters of a century. The demise of sharecropping had a considerable influence on the rural South's old Black Belt (Kirby, 1983; Vandiver, 1978).

> When planters decided to alter fundamentally their mode of production - as they did most dramatically during the 1930s and 1940s - much of the region was convulsed. Millions of people were dispersed to cities. Sharecropping shrank to insignificance. And mules, symbols and factotums of traditional farm life, became rare. The southern landscape was depopulated and enclosed; agriculture at last became capital intensive (Kirby, 1983: 257).

Sargen (1979), in a comparative study of the mechanization of American agriculture between the turn of the twentieth century and World War II, notes that the economic rationale for the adoption of tractors was more evident in the North and Midwest than it was in the South. He proposes, in fact, that on the eve of World War II the very cheap labor requirements of the sharecropping system continued to make it more economically efficient for planters to continue that system rather than to consolidate the land parcels via the adoption of labor-saving technologies such as tractors and self-propelled harvesters. Vandiver (1978) proposes that the mechanization of cotton production was as much a response to the perceived unreliability of sharecropper labor due to labor organizing efforts during the 1930s as it was to market incentives. By the end of World War II, sharecropping was being eclipsed by large-scale farms that often relied upon hired managers and hired laborers. These new farm types were clearly industrial in character, and not commercial family farms.

The Ascendency and Decline of Commercial Family Farms

The economic and social upheaval caused by the Civil War and the introduction of regional market structures facilitated the emergence of commercial family farms and tenant family farms. However, the ascendency of these two types of family-labor farm structures was not without social and economic hardship. (A discussion of the economic forces shaping the transition of farming in America during the twentieth century is presented on page). The economic and social viability of family farming was now dependent upon survival in a highly competitive marketplace. The difficulties of family farms in all regions of the nation during this period were evident in the rise of the landless family farms in the form of tenancy and the populist movement.

The populist movement still defies easy academic categorization. While it was clearly associated with the rise of the trade union movement in the industrial centers, it remained a rural political phenomenon. In his book The Roots of Southern Populism, Hahn articulates its rise in terms of the transition of family farming from a quasi-subsistence mode into a commercial production unit. In the South, the populist movement was a reaction to the continued political domination of the planters and the rising industrial elite. The political agenda was a:

> critique of the emerging social order imbued with a common spirit; they lashed out at the increasing concentration of wealth and power in the American economy; they decried the new conditions of dependency that came to define production relations; they assailed what they believed to be the attendant corruption of the democratic process; and they held out a vision of a cooperative commonwealth of producers to be realized through public regulation of production and exchange (Hahn, 1983: 2).

Commercial family farmers found that the terms of trade in the marketplace were not equal, and argued for political and economic reforms to address these inequalities. Their vision of society was a mixture of antebellum values of independence and community coupled with the desire to participate in the economic benefits of the industrial revolution. Genovese (1965: 162) argues that the antiindustrialism and anti-urbanism of the South was particularly virulent:

> An agrarianism uncompromisingly hostile to industry and urbanization - to "manufacturing as a system" - existed only in the South and cannot be separated from the ideological leadership of the slaveholding planters.

By the Great Depression the populist movement had lost its political clout as the American population became more urbanized. However, many of its proposed agricultural policies were reflected in the farm programs of the New Deal.

The high water mark of family farming in the South, including both tenant and full owner farms, was the Great Depression. Since that period, both types of farms have declined in numbers and in their contribution to total agricultural production in the South (see Table 1). Perhaps the latter measure is the best indicator of the decline in the importance of family farming since World War II. While family farms presently are the numerically dominant farm type in the South, with a few exceptions, they no longer produce the majority of agricultural products. The most important exception is the production of tobacco where New Deal production control programs have facilitated the persistence of small scale family farming (Mann, 1975).

Farm Structure in the New South

Since World War II, the economic and social forces shaping the structure of American agriculture have also been central to Southern agricultural production. However, the South, unlike many other regions, is not easy to categorize in terms of farm structure. In the deep South where the plantation system was strongest and both cotton and sugar cane are still raised, there is a greater preponderance of industrial-type farms and larger-than-family farms. But, these two commodities have never been raised by family farms. On the other hand, both Kentucky and North Carolina are centers for tobacco production and are characterized by a proportionately larger number of small family farms. Consequently, current farm structure in the South reflects both the historical legacies of the antebellum period and the early years of the South's industrial revolution, and the labor, capital, and biological requirements of particular commodities.

The Industrialization of the Postbellum Rural South

Throughout the antebellum period, local societies differed according to the differential influence of the farming structures within their hinterlands. Agricultural trade centers for cotton, sugar cane, and tobacco had a particularly agrarian economic and social texture, and were politically and economically controlled by the plantation class. The rural backlands of the south, on the other hand, were very much influenced by the economy and society of yeoman family farms.

The anti-industrial policies of the plantation class subverted the emergence of even a textile industry. In 1860, New England alone had three times as many textile factories as the entire south with a total capital investment for each factory twice that of the South (Genovese, 1965: 165). Consequently, there were few industrial centers in the antebellum urban south and rural industrialization was almost nonexistent.

Agricultural trade centers that serviced a yeoman family farm hinterland were generally untouched by the plantation class (Hahn, 1983). Their primary function was to provide local markets for locally produced commodities, with some ties to urban trade centers.

> Tiny courthouse towns and hamlets served as the primary marketplaces. ... Shoemakers, carpenters, blacksmiths, and millers, some of whom owned farms, proffered essential goods and services for their neighborhoods (Hahn, 1983: 38-39).
>
> Lacking an industrial base or diversified [nonagricultural] commercial enterprises, these towns depended on agriculture and, increasingly, staple agriculture for their existence (Hahn, 1983: 178).

Therefore, during the antebellum period and the decades following the Civil War, Southern agricultural trade centers were dependent upon their farming hinterlands. Their limits to growth were determined by the productivity of their agrarian sectors.

The Transition to an Industrial Society

The rapid rationalization of the American economy has been pervasive but uneven, especially within regions that were late in undergoing the process. Emblematic of the emerging advanced capitalist society has been the redistribution of the population around trade and manufacturing centers - the twin processes of urbanization and industrialization. The growth of urban areas and manufacturing required a source of wage labor, increased agricultural production to feed the industrial work force, and a source of raw materials for industry. Each of these were available in the rural South. Consequently, the rural South was a necessary partner in the modernization of Southern society, but not an equal partner in sharing the wealth generated.

The rate of modernization between urban and rural areas has been uneven since nonfarm, indeed nonrural, capital first penetrated the hinterland and established the necessary internal markets, that the rural economy could not have done as quickly on its own. As the agricultural trade centers and their farming hinterland entered long-distance trade with the emerging industrial centers, their social and economic functions began to reflect the requirements for facilitating and reproducing the new trade and industrial relations. Previous social formations, such as autonomous rural churches or one-room six-grades schoolhouse, whose function was the persistence of yeoman family farming gave way to the demands of external trade. Horizontal ties that facilitated local production and consumption were subordinated to the economic realities of emerging vertical ties with distant economic and social institutions (c.f., Warren, 1978; Bender, 1978). Eventually, a trade center's persistence became less dependent upon internal exchange and more dependent upon its position within the new regional and national market structure.

The requirements for capital accumulation of the new industries included a geographical spatial organization that facilitated the speedy circulation of capital, access to new sources of industrial labor, and the establishment of public and private institutions that prepared and supplied an industrial labor force (e.g., standardized public schools, public health, concentrated retail firms, etc.). Once autonomous communities were pulled into the regional market and a hierarchy of central places emerged. Christaller (1966) has used central place theory to describe the structural and spatial distribution of a regional market and social network in terms of the "spatial arrangements of various sized central places and the functions they provide to their surrounding area" (Forsht and Jansma, 1975).

The penetration of internal markets and the resulting spatial organization also facilitated the development of commercial nonfarm industries within the rural hinterland. These internal markets tended to open the way for manufacturing firms to locate in rural areas. These firms were generally peripheral in character, often looking for new sources fo cheap labor. Billings (1979) has examined the industrialization of rural and urban areas of North Carolina following the Civil War. He found that both planter capital and new bourgeois capital (most notably the Duke's of Durham) employed both white and black labor. Small agricultural trade centers such as Durham, North Carolina rapidly expanded both their industries and population. In 1865, Durham Station had a population of less than 500, yet by the turn of the century, it boasted a population of almost 90,000. However, the racial segregation that characterized both the plantation and yeoman societies persisted in the expanding industrial labor force.

The availability of indigenous capital after the Civil War appears to have varied by region. While Billings (1979) provides evidence that former plantation owners and wealthy farmers invested heavily in new manufacturing enterprises, especially textile mills, in North Carolina, Mann (1984) proposes that among the Gulf states, such heavy investment was not common. Therefore, capital scarcity was a major problem for some areas of the South during the postbellum period, and this scarcity contributed to the uneven development of industry during the past century.

The introduction of manufacturing into the hinterland provided a source of nonfarm employment that could compete for labor and capital with the farm sector. Furthermore, the locally generated income tended to increase the area's consuming ability. The introduction of manufacturing led to a decline in the dominance of farm production as the principle economic activity in the hinterland, and, therefore, provided an important influence on trade center persistence and change.

The expansion of industrial production into the hinterland fundamentally reorganized the formerly independent rural society. The new division of labor among these trade centers within the regional economy did not necessarily include all of the former trade centers. Those agricultural trade centers not strategically positioned in the regional economy at best remained stable, continuing to be dependent upon farm production. However, this dependence made them vulnerable to changes under way in their farming sector.

Therefore, both farm change and trade center change have been independently influenced by the ascendency of an advanced industrial economy. Farming has lost much of its mystique as a unique way of life, and gained a new image as a way of business. The farm sector has become more concentrated as marginal farms go out of production and the remaining farms wither expand production or seek off-farm employment to supplement sagging farm income. Once isolated trade centers are now members of the regional economy's hierarchy of places. as manufacturing and tertiary industries expand their influence, these trade centers gradually cease to be bucolic country villages and become industrial-based communities. Most have lost their functions associated with the yeoman family farm or plantation system, and, if centrally located, gained new functions associated with the requirements of an industrial society.

The rationalization of the Southern economy and society, then, has been pervasive but uneven. The rate of rationalization between urban and rural areas has been especially uneven. The emerging regional market structure required a spatial organization that facilitated the accumulation of capital, the circulation of capital, easy access to necessary labor, and efficient utilization of public institutions that educated, supplied, and kept healthy an industrial labor force. This spatial organization has greatly influenced which trade centers persist and which are left behind. Those communities that remained primarily dependent upon their farming hinterland are thought to be the most likely to experience a decline in their populations, quality of services, and in their retail establishments (see Whiting, 1974).

Southern rural society presently is influenced by a myriad of economic and social conditions, both endogenous and exogenous to their territorial boundaries. Their ecological characteristics - such as demographic structure, economic base, and social stratification - are both mediated through as well as influenced by regional and national socio-economic factors. Therefore, it is difficult to determine empirically the exact association between the viability of their economic and social institutions and changes in farm structure.

However, the national literature on farm and community change, which includes few Southern cases, provides an incomplete conceptual framework supported by some empirical findings of this association.

APPENDIX B

Literature on Farm and Community Change

There are numerous studies that examine the suspected impact of farm change on trade centers. In general, these studies hypothesize that as farm structure becomes more concentrated - farm numbers decline, farm size increases, and there is a greater dependency upon hired labor - rural communities will experience a decline in population, retail establishments, voluntary organizations and other measures of social well-being. Goss (1978: II.39) has succinctly reviewed these assumptions:

> The root cause of the decline in smaller places has been with technological change and farm size expansion and their immediate consequences of labor displacement, farm outmigration and a decrease in the density of people on the land ... A decrease in the number of farms and density of farm people reduces the aggregate demand for [economic and social] functions, and consequently the need for nonfarm persons responsible for supplying such goods and services.

However, there are few empirical studies that examine how declining farm numbers and people and the changing farm workplace influence trade center change in the context of other regional economic and social change. While Goss implicitly assumes that agricultural technological change is responsible for these adverse effects of community well-being, in another paper with Rodefeld (Goss and Rodefeld, 1978), it is proposed that technological changes, at best, have only an indirect influence upon community change. Instead, they argue that the influence of technological change is mediated through particular types of farm structure. An alternative view would be that technology, rather than an antecedent and autonomous cause of farm concentration, instead reflects farmers' efforts to adopt the powers of technology in order to improve their position, or, at worst, not lose ground, in a highly competitive market. The influence of technology will developed at greater length below.

Demographic studies of the impact of farm change on nonmetropolitan counties report that counties with a preponderance of small-scale family farms have usually experienced population loss as farms have become more concentrated (Frisbie and Poston, 1978). Between 1960 and 1970, these predominately agricultural counties were more likely to have outmigration. Similar ecological analysis of community population change also identify an inverse relationship with increased farm concentration. Munoz and Flinn (1977) examined both incorporated and unincorporated places in Ohio for the period 1930 to 1970, using county-level agricultural data. They found that increases in average farm size and value of farm land, and decline in farm residents were associated with community population decline. They also noted that increased part-time farming was positively associated with place population change, indicating that as part-time farming becomes more prevalent in a county, smaller places are less likely to decline in population. Their findings also suggest that during this period, those counties where farming co-exists with other economic activities, the farm population is more likely to be stable.

The Goldschmidt Study

Very few studies of farm and community change focus upon changes in the economic viability and quality of life of these communities. Instead, most studies use population as a surrogate for community well-being, with places increasing in scale being relatively more economically and socially viable than those place losing population. This assumption, obviously, may not always hold true. Among the few studies that do focus on economic viability and social well-being, Goldschmidt's (1978) 1944 case study of two California farming trade centers is the most often cited.

Goldschmidt selected Arvin and Dinuba according to what he believed were similar ecological characteristics. Goldschmidt argued that both towns were located in the San Joaquin Valley, were satellites of large metropolitan centers, relied upon agricultural production, and were dependent upon irrigation systems. Arvin's hinterland tended to produced row crops like cotton, while Dinuba's grew tree crops and vegetables. The major difference between these two farming centers were the structure of the farms in their hinterlands. Arvin was dominated by a few large, industrial-type farms characterized by absentee ownership and a dependence upon hired labor, primarily hispanics. Dinuba primarily consisted of family farms and larger-than-family farms, with the labor force dominated by family members. Goldschmidt's dependent variables were economic indicators of retail vitality and social indicators of quality of life. He reported an astonishing array of differences between Arvin and Dinuba, and attributed these variations to the different farm structures in their hinterlands. Goldschmidt concluded that because Dinuba, with its relative dependence upon a family farm hinterland, had demonstrated more economic and social vitality than Arvin, with its industrial farm hinterland, that the differences were due to farm structure. By implication, Goldschmidt proposed that as farms become more concentrated and assume an industrial workplace structure, the quality of economic and social life will decline. Or, more simply, as farms become more concentrated, rural communities will experience a decline in their quality of life.

The Goldschmidt study has been loosely replicated in recent years. Petterson (1977), reports that the major differences between Arvin and Dinuba continue to persist. Fujimoto (1977) expanded Goldshmidt's study to an ecological analysis of 130 places in eight counties within the San Joaquin Valley. Again, Goldschmidt's findings were confirmed. Places dominated by large-scale agriculture had fewer economic and social amenities.

More recently, Goldschmidt's study has been questioned. Hayes and Olmstead (1984) argue that many factors other than differences in farm size contributed to Arvin's low quality of life. They propose that "rather than being closely matched communities, the two towns had developed within significantly different economic, demographic, and geographic settings" (Hayes and Olmstead, 1984: 430). While Hayes and Olmstead do not counter Goldschmidt's most important conclusion that large farms accounted for differences in community characteristics, their findings do question both the immediate findings for the 1944 study and its generalizability to other regions of the country.

Rodefeld (1974) examined how increased farm scale and workplace differentiation influenced the character of Wisconsin farm people and the ways they participate in local society. He found some support for Goldschmidt's general hypothesis that the rationalization of the farm labor process eventually leads to undesirable community characteristics. Rodefeld's findings included significant differences among three status groups: owner-managers, hired managers, and hired laborers. Owner-managers (i.e., traditional family farmers) were more likely to have high rates of participation in community organizations, whereas hired laborers generally did not participate in community organizations.

Flora, Brown, and Conboy (1977) also attempted to roughly test Goldschmidt's basic theses. However, their results provide evidence that the Goldschmidt hypothesis is not generalizable to all regions. They report two general findings. First, while counties with a higher concentration of industrial-type farms were positively related to overall county wealth, there was a negative association between the amount of wealth created and the equity of income distribution. Therefore, the more a county's farm structure had an industrial character, the higher the proportion of hired farm laborers as a proportion of all persons employed in agriculture. These results suggest that a large number of low-wage hired laborers were dependent upon a small number of large farming operations. However, their second finding was less consistent. They report that as the ratio of hired farm labor increases relative to the number of owner-operators, county and per capita income also rise. While there may be numerous methodological problems such as ecological fallacy that might account for this finding, it is doubtful that the general relationship would be changed. This study clearly presents an anomalous case for the Goldschmidt theses.

Another study of farm and community change which is not totally consistent with the Goldschmidt thesis is Swanson's (1982) study of Pennsylvania for the period 1930-1960. Swanson identified 520 rural trade centers and their farming hinterlands in the thirty counties having the largest proportion of their labor force employed in agriculture in 1930. The empirical results suggest that declining farm numbers was not significantly associated with trade center population change during the thirty year period. However, as the average farm scale, measured in total acres harvested, increased, trade center population increased. Swanson attributed this apparently contradictory finding to the small average increase in acres harvested per farm of about 16 acres. Family farms could have mechanized their operations, thus extending their labor, which would mean that increased farm scale was not necessarily associated with changes in farm structure. In other words, while the total number of farms declined and farm scale increased slightly, the hinterlands of these trade centers continued to be dominated by family farms.

The most interesting finding of Swanson's study was that region economic changes were the primary factors influencing trade center population change and farm change. His study suggested that changes in trade center population and farm structure were influenced by changes in regional economy. This observation offers some support for the hypothesis that as a regional economy becomes more developed, its economic and social institutions will have a greater influence on community change than will changes in the farming hinterland. Furthermore, because the introduction of these nonfarm sustenance activities provide off-farm employment opportunities for the farm population, smaller farms that might otherwise go out of production can continue to operate if one or more member of these farms works off the farm. The availability of part-time farming as an option to leaving farming provides a means for family farm persistence even during a period of rapid farm concentration. This does not mean that the decision to enter part-time farming is a happy one, but it might be seen as a better option than going out of production.

None of these studies occurred in the South which makes it difficult to determine whether or not they are applicable to farm and community change in this region. Furthermore, even among these studies it is apparent that farm concentration may not have the effect of always undermining community well-being. Perhaps these findings can be summarized as follows. In areas where there are no off-farm opportunities, a decline in farm numbers and an increase in farm size will contribute to a decline in indicators of community well-being. But, in areas where there has been an increase in the nonfarm economic activity, the changing characteristics of the regional economy will exert an even stronger influence on the persistence of former farm trade centers. This would suggest that trade centers will transfer their economic and social dependency from their farming hinterlands to the regional economy as the expansion of internal markets increase their dependency on vertical ties with the larger society.

APPENDIX C

Statistical Analysis of Farm Structure and Rural Well-Being

Methods of Research

The goals of this research are two-fold. First, to estimate the association of general categories of farm production technologies with both farm structure and change. Since other farm production conditions may also be associated with both farm structure and production technologies, some control variables are also introduced. The second objective is to determine the association of farm structural change with community well- being. Once again, other factors may also influence both community well- being and farm structure, making it necessary to use control variables.

The objectives of this research require data on farm structure and community well-being. Unfortunately, regional data at the community level are not available through traditional secondary sources. Consequently, county level data were used with the understanding that a county is not a direct measure of community. Furthermore, data were not available for individual farms within each county, making it necessary to use aggregate farm data. Both the use of county as a surrogate for community and aggregate county-level farm data, limit this research in making inferences about community well-being and individual farm structure and change. However, given these limitations, inferences about general tendencies in community well-being and individual farm structure based upon aggregate county data provide indirect indications of farm structure and community well-being in the South between 1969 and 1980.

The data for this study were taken from three reliable sources: the census of population, the County City Data Book, and the census of agriculture. The definitions and procedures used by the Census Bureau, which collect all of these data, are well documented.

This section presents the procedures for measuring concepts to be described and analyzed. Even though measurement is considered to be a crucial dimension of the scientific approach, the implicit assumption of the validity of inference is often ignored. This assumption states that conceptual frameworks, such as the one presented above, are not directly observable, and therefore must be inferred from phenomena that are directly observable. This epistemological link between the unobservable and the observable is only as strong, i.e., valid, as the relative closeness between the measure and the concept. In sociology and economics, many of the concepts are neither objects or events, which means that direct measurement is impossible. Fortunately, in this study, the conceptual variables were relatively straightforward. Consequently, there is reason to believe that inferences are possible between the conceptual framework and the observable phenomena represented by the census data. The measurement of the variables is briefly presented below in order to allow the reader to evaluate the epistemological linkages. Table 5.1 offers a summary of the operational definitions for the variables used in the analysis.

Farm Variables

Farm structure is a somewhat nebulous concept. In this research it refers to various dimensions of farm economic and social organization which provide general indicators of workplace organization, factors of production such as technology and nonfamily labor, potential for capturing economies related to scale, and the relative importance of farm production and the farm population within the larger county socio-economic organization.

Farm structure may be conceptualized in at least three ways, (1) total farm numbers, (2) average farm scale, and (3) dependency of farms on off- farm employment. Each of these concepts are operationalized in this study and employed as a dependent variable. Farm number was measured directly. The total number of farms for each county as reported by the census of agriculture in the years 1969 and 1978 were used. However, there were some differences in the definition of a "farm" for these two points in time. In 1969 a farm was defined as any production unit with a minimum of 50 acres or $250 in total agricultural sales. By 1978, the definition was set at any production unit with $1,000 or more in total agricultural sales. These definition differences would mean that a given production unit was more likely to be counted as a farm in 1969 than in 1978. While inflation during this ten year period had the effect of reducing the actual differences, the reader should keep in mind that these definition differences will introduce some minimal bias into the analysis.

There are two traditional measures of farm scale, one based upon total acres operated and the other on total farm sales. The analysis demonstrated a consistency between these measures as indicated by their Pearson's r of .56. As a result, it was determined that only one scale measure would be used. Average farm sales was chosen. Given the great diversity of crops and livestock raised in the South, it is possible that a poultry operation may have a total acreage of 10 and yet have gross sales of over $100,000 while a grain operation may have over 100 acres and gross sales of less than $100,000. However, the analysis of average acres was considered to be important enough to be included in Appendix A for the interested reader.

Part-time farming was measured as the proportion of all farms on which the operator reported working off the farm for more than 99 days. This variable provides a measure of dependency upon off-farm income for supplementing both total family income and farm expenses. Coughenour and Swanson (1983) have noted that the scale of operation is most likely to be significantly lower if the farm operator works off the farm than if the spouse works off the farm. However, this variable as operationalized does not measure the importance of the spouse's off farm work to either the family income or to the farm operation. Because of its conceptual importance in influencing the scale and number of farms, part-time farming was also used as an independent variable.

In addition to part-time farming, six other variables were used in the analysis. These were: (1) land-saving technology expenses per farm, (2) average value of machinery per farm, (3) non-family labor expenses per farm, (4) concentration of small farms in a county, (5) percent of full-owner operators of all farms, and (6) the county's level of unemployment.

A central objective of this research is to determine the influence of various types of farm technologies on both farm structure and change. Since the census data for 1969 and 1978 are not specific enough to analyze particular technologies, two general measures were developed. The first measure was for land-saving technologies, i.e., technologies that increase the productivity per acre. This variable was operationalized by summing the total expenses for fertilizers and other production chemicals (which includes herbicides and insecticides). By dividing the total county expenses for these chemicals by the total number of farms, an average expenditures per farm was computed. The second measure was for land-saving technologies, i.e., technologies that increase the productivity of labor. Since the primary method of increasing labor productivity is the use of machinery this variable was operationalized as the average value of machinery per farm.

Several farm workplace organization variables were used. As farms increase in scale they often reach threshold beyond which labor- and land- saving technologies cannot enlarge total production thus making it necessary to employ nonfamily labor. The introduction of nonfamily labor is a conceptually important event since it diminishes the importance of family labor and increases the farm operation's dependence on hired or contract labor. Nonfamily labor expenses was computed by summing total expenditures for hired and contract labor and dividing the sum by the number of farms. This provided an average expenses for nonfamily labor per farm for each county. Two other variables were also used that act as indicators of workplace organization: (1) concentration of small farms in a county, and (2) percent of farms of farms that have full-owner operators.

The concentration indicator was operationalized in a manner similar to a Gini coefficient. The full-owner operator variable was directly measured by the census. Full-owner operator farms are those on which the operator owns all the land and equipment - typically called a "family" farm.

The sixth independent variable was the percent of unemployment in a county. It was assumed that this variable measured the general state of a county's economy and served to reflect off-farm employment opportunities. This measure was consistent for both 1970 and 1980. All variables related to sales or income were standardized in 1982 dollars in order to control for inflation. The GNP deflator was used. All dollar-based figures, then, are in 1982 dollars

County Well-Being Variables

Goldschmidt's study concluded that as farm structure becomes more concentrated that community well-being would suffer. In order to operationalize this hypothesis community well-being and farm hinterland data are necessary. However, as noted above, secondary data sources are not available for such small units of analysis. Therefore, this research will analyze how community well-being is associated with farm structure and other types of variables.

The analysis used six dependent variables as indicators of different dimensions of county well-being: (1) median family income,(2) percent of families below poverty, (3) percent of unemployment, (4) county population, (5) number of retail establishments, and (6) property taxes per capita. The first three variables are analyzed in the main report and the last three are analyzed later in this Appendix.

Most of these variables are relatively direct measures of their concepts. County population was the reported population for the 1970 and 1980 censuses. The percent of families below poverty is consistent for both points in time. Median family income was preferred over average family income, since in many counties there were highly skewed distributions of wealth. This measure indicates that half of a county's families had lower incomes and half had higher incomes. Unemployment was also measured in a comparable manner for both points in time.

The number of retail establishments was used, but primarily because of results from previous studies. Fuguitt and Johanson (1973) for example report that as population declines, so will retail establishments. Bauder (1959) reported that as farm numbers decline so will retail establishment. Similarly, the property taxes per capita also indicate a county's well- being by measuring its ability to raise revenue necessary for essential public services. The lower the revenue per capita, it is reasoned, the lower the level of public services offered locally. Both the number of retail establishments and the property tax per capita were obtained from the County City Data Book.

The final conditional variable controlled for the counties proximity to the economic and social influence of metropolitan counties. The measure used was developed by Beale.

Method of Analysis

The data were analyzed in three stages. First, the descriptive statistics available for farm structure and county well-being were examined. Two types of comparisons were investigated, (1) a comparison of the South for 1970 and 1980, and (2) a comparison with the rest of the nation (excluding the South). Second, cross-sectional linear regression models were constructed and their results analyzed for

1969/70 and 1978/80 for farm structure and county well-being. Third, the ways in which these models changed for the two points in time were analyzed. For this last stage, an additional control variable was included, the 1969/70 value of the dependent variable. This control permits the model to estimate the importance of uneven development, one of the concepts discussed above.

Only nonmetropolitan counties were analyzed. A nonmetropolitan county is any county that lies outside the economic and social influence of a metropolitan area with a population center of 50,000 or more. All comparisons with the rest of the nation also were limited to nonmetropolitan counties.

Methodological Issues

The analysis required two general stages: (1) an analysis of the association of production technologies and farm structure, and (2) an analysis of the association of farm structure with community quality of life. Each of these stages involve two types of analysis, a cross-sectional analysis of both points in time and an analysis of change. The Pearson product-moment correlations (Pearson's r) were used for the analysis of bi-variate associations. This statistical technique is often referred to as a zero-order correlation since no controls for the influence of other variables are made. Pearson's r measures the goodness of fit of a linear regression line to the data, and when r is squared, it gives the proportion of variance in one variable explained by the other. However, since this measure of association does not control for the influence of other variables, the actual variation observed may be misleading. Rosenberg (1968) in his text on multivariate causal analysis points out that simple bivariate relationships may supress or amplify actual variation due to the absence of key explanatory variables. In this analysis, the Pearson's r is used cautiously. Determination of net effects was based upon the use of multiple regression analysis.

Multiple regression analysis is an extension of the simple linear regression model used to calculate Pearson's r. This general statistical technique permits the researcher to analyze the relationship between a dependent variable and a set of independent variables.

The specification of each model is dependent upon the conceptual framework and available data. None of the following models were completely specified, thus leaving room for the omission of a key unidentified or unmeasured variable. Several key concepts are not included in both types of models. The farm structural models lack any information on market conditions such as price and demand. Furthermore, there is no data on debt/asset ratio. This last variable, as we noted earlier, is critical to any assessment of farm structure and change. Nor is there any data that might indicate the influence of farm policies such as price supports and tax structure. In addition, the technology variables do not include bio- technologies, such as hormones, that increase the size of livestock, improve the efficiency of poultry feed, or permit greater milk production.

The community quality of life model contains the serious omissions of no data on race. Given the South's long history of racial discrimination in all dimensions of economic and social activity, and given this study's focus on quality of life, the omissions of racial factors is a major short- coming. However, the reader might keep in mind that poverty and low median family incomes do not discriminate by race. Numerically, there are many more poor white families than black or other minority groups. But, the proportion of blacks in poverty greatly exceeds the proportion of whites in poverty. While the quality of life dependent variables are excellent measures, they do not measure all dimensions of a community's well-being. There is no measure of family and social stress, of crime, of anomie and alienation associated with poverty and low-wage labor. Nor, among the many independent variables are there clear indicators of labor force segmentation, the distribution of wealth, or the average wage-rate of local industries. Therefore, these models should be considered to be relatively limited. It does not reflect well upon earlier efforts that these models are the most completely specified models of farm structure and county well- being at the regional level to date.

Since this study constituted a complete enumeration of nonmetropolitan counties in the South, any net effects observed were not the consequence of sampling error. The inclusion of all possible cases meant that any error was due to either coding or measurement or both. However, there still is the need to set criteria for substantive significance. Therefore, given the two-tale character of the significant test used, the .01 level of significance was choosen.

Farm Structure Models

Three farm models are presented here. The dependent variables for these models are: (1) average farm size, (2) farm numbers, and (3) part-time farming. These variables represent traditional measures of farm structure. The research question is "how are farm technologies associated with farm structure and change." Consequently, the first two independent variables measure land- and labor-saving technologies.

Four independent variables are introduced that measure conceptually different dimensions of the county's farm workplace characteristics. The first, average expenditures on nonfamily labor, measures the degree of dependency of a county's farms on nonfamily labor. As farms become more concentrated, there is a tendency for both hired and contract labor inputs to increase. The second variable measures the predominance of farms with less than 180 acres. Since smaller farms are generally family operations, this measure provides a general indication of the function of small farms on a county's farm structure. The third independent variable provides a measure of family farming, as operationalized as full-owner operators. These are farms on which the family owns all of the land resources. The fourth independent variable is a county's level of unemployment.

The analysis of the data cannot be thoroughly analyzed and still maintain a clear focus on the research problems at hand. Therefore, only the first dependent variable of the farm structure model will be examined in depth. The reader can use this initial analysis as an example of how the subsequent models can be examined. For the remaining models only the most relevant and anomalous associations will be discussed at any length.

Average Farm Scale

Average farm scale, measured as gross agricultural sales, is a traditional measure of size. It has some advantage over the average number of acres when only aggregate county data is available since some commodities like poultry or tobacco can yield a high volume of sales on a very few number of acres.

Tables C.1 and C.2 present the zero-order correlations for the cross-sectional analyses of farm structure in 1969 and 1978 respectively. In 1969, average farm size is significantly associated with all other variables. As expected, both indicators of production technologies are positively and strongly associated with the dependent variable (land-saving technologies, r = .683; average value of machinery, r = .736). This suggests that the higher the level of technological inputs in a county, the larger the average sales of a farm.

The farm workplace variables also are associated with farm size in the expected direction. As the average expenditures on nonfamily labor increase so does the average scale of a farm (r = .737). The variable indicating the concentration of smaller farms is negatively associated with the dependent variable (r = -.447), giving evidence that the higher the concentration of smaller farms in a county the lower the average scale of farm operations. Similarly, as as the percent of full-owner farms increases in a county, the scale of farms decreases (r = -.540).

The other farm workplace variable, the percent of part-time farm operators, also is in the expected direction. As the proportion of farms in a county on which a farm operator works 100 or more days off the farm increases, the scale of operation decreases (r = -.462).

The final independent variable, percent of the county's labor force that is unemployed, was included as a control on available nonfarm labor. Unemployment was weakly but nonetheless significantly associated with with farm scale (r = -.140). As county unemployment decreases, average farm scale increases. This is interesting since the Goldschmidt thesis would expect unemployment to be positively associated with average farm scale.

Some of the associations among the independent variables are equally of interest, since they too lend support to the conceptual framework offered above. The two technology variables are positively and highly associated with one another (r = .829). Statistically,

Table C.1: Zero-Order Correlations: Cross-Sectional Analysis of Farm Structure in 1969

Y1	Number of Farms	X4	Concentration of Small Farms
Y2	Average Farm Size - Sales	X5	Percent Full-Owner Operator
Y3	Percent Part-Time Farming	X6	Percent Tenant Operator
X1	Land-Saving Tech. P/F	X7	Percent Grain
X2	Av. Value of Machinery P/F	X8	Percent Livestock
X3	Av. Expend. on NonFamily Labor	X9	Percent Unemployment

	Y1	Y2	Y3	X1	X2	X3	X4	X5	X6	X7	X8
Y1	--										
Y2	-.104*	--									
Y3	-.222*	-.462*	--								
X1	-.162*	.683	-.544*	--							
X2	-.140*	.736*	-.541*	.829*	--						
X3	-.151*	.737*	-.465*	.738*	.830*	--					
X4	.400*	-.447*	.228*	-.567*	-.566*	-.424*	--				
X5	-.065	-.540*	.690*	-.728*	-.774*	-.676*	.389*	--			
X6	.149*	.455*	-.690*	.548*	.648*	.604	-.253*	-.896*	--		
X7	.006	.309*	-.409*	.473*	.651*	.336*	-.332*	-.607*	.464*	--	
X8	-.071	-.402*	.336*	-.281*	-.274*	-.274*	-.167*	.318*	-.282*	-.262*	--
X9	-.003	-.140*	-.049	-.105*	.036	.046	.043	-.022	.066	.178*	.100

* = Statistically Significant at the .001 Level

Table C.2: Zero-Order Correlations: Cross-Sectional Analysis of Farm Structure in 1978

Y1	Number of Farms	X4	Concentration of Small Farms
Y2	Average Farm Size - Sales	X5	Percent Full-Owner Operator
Y3	Percent Part-Time Farming	X6	Percent Tenant Operator
X1	Land-Saving Tech. P/F	X7	Percent Grain
X2	Av. Value of Machinery P/F	X8	Percent Livestock
X3	Av. Expend. on NonFamily Labor	X9	Percent Unemployment

	Y1	Y2	Y3	X1	X2	X3	X4	X5	X6	X7	X8
Y1	--										
Y2	-.057	--									
Y3	-.121	-.600*	--								
X1	-.161*	.730*	-.665*	--							
X2	-.107*	.778*	-.695*	.885*	--						
X3	-.123*	.766*	-.577*	.738*	.814*	--					
X4	.323*	-.461*	.397*	-.635*	-.666*	-.497*	--				
X5	.352*	-.126*	.220*	-.404*	-.393*	-.366*	.251*	--			
X6	.107*	.561*	-.743*	.611*	.744*	.698*	-.408*	-.367*	--		
X7	-.040	.325*	-.386*	.524*	.640*	.331*	-.447*	-.394*	.474*	--	
X8	-.120	-.595*	.498*	-.458*	-.472*	-.450*	.039	.108*	-.458*	-.336*	--
X9	-.007	-.299*	.090	-.200*	-.195*	-.215*	.198*	-.000	-.141*	.022	.248*

* = Statistically Significant at the .001 Level

this might be considered to be a multicolinear association, but conceptually, these variables are not tautologically related. Their strong association simply indicates the obvious, that large scale farms utilize both types of technology to achieve their greater sales. Similarly, the association between average expenditures on nonfamily labor and average value of machinery (r = .830) indicates that among the very large farms, the operations have achieved such large scales that labor-saving machinery is not enough to maintain their scale. Nonfamily labor, both hired and contract, are necessary to supplement family labor.

Table C.2 presents the zero-order correlations for the cross-sectional analysis of farm structure in 1978. A comparison of Tables C.1 and C.2 demonstrates that with minor shifts in the degree of association, all of the independent variables are significantly associated with one another, and are in the same direction (i.e., positive or negative). Therefore, the interpretations given for 1969 also apply for 1978.

Table C.3 provides the zero-order correlations for the change analysis of farm structure between 1969 and 1978. Change was measured by subtracting the aggregate value of 1969 from 1978. In order to control for initial size in 1969, that value was entered as an independent variable. It has the additional conceptual usefulness of controlling for the socio- economic inertia of initial farm scale.

These correlations are all statistically significant at the .01 level. Both of the technology independent variables are strongly and positively associated with the dependent variable. During this decade, those counties where expenditures on land-saving technologies (r = .717) increased, farm scale also increased. Furthermore, in those counties where the value of machinery per farm increased, average farm scale was likely also to have increased. Recall that all monetary figures have been standardized in 1982 dollars, which helps control net effects due to inflation. Therefore, these are real dollar increases in both expenditures on agricultural chemicals and machinery. Both land- and labor-saving technologies appear to have facilitated the increase farm scale between 1969 and 1978.

Similarly, in those counties where average expenditures on nonfamily labor increased' so too does average farm scale (r = .461). This indicates that in addition to greater use of chemicals and machinery, an expansion of scale often required greater expenditures on nonfamily labor.

Three of the four farm workplace variables were significantly associated with increased farm scale. As the concentration of small farms declined in counties, average farm scale increased (r = -.295). Similarly, in those counties where part-time farming increased, average farm scale decreased.

The reader is strongly encouraged to examine the correlation tables, since they will not be interpreted. However, the reader should remember that simple bi-variate associations often do not

Table C.3: Zero-Order Correlations: Change Analysis of Farm Structure Between 1969 and 1978

Y1	Number of Farms	X4	Concentration of Small Farms
Y2	Average Farm Size - Sales	X5	Percent Full-Owner Operator
Y3	Percent Part-Time Farming	X6	Percent Tenant Operator
X1	Land-Saving Tech. P/F	X7	Percent Grain
X2	Av. Value of Machinery P/F	X8	Percent Livestock
X3	Av. Expend. on NonFamily Labor	X9	Percent Unemployment
		X10	1969 Value of Dependent Var.

	Y1	Y2	Y3	X1	X2	X3	X4	X5	X6	X7	X8	X9
Y1	--											
Y2	-.085	--										
Y3	-.056	-.173*	--									
X1	-.061	.717*	-.172*	--								
X2	-.069	.748*	-.130*	.874*	--							
X3	-.201*	.461*	-.115*	.371*	.332*	--						
X4	.394*	-.295*	.080	-.387*	-.423*	-.244*	--					
X5	-.128*	.495*	.070	.476*	.559*	.101*	-.146*	--				
X6	.204*	-.073	-.066	-.108*	-.096	.044	.185*	-.338*	--			
X7	-.157*	.062	-.034	.281*	.299*	-.078	-.297*	.151	-.141*	--		
X8	.146*	-.471*	.068	-.400*	-.436*	-.241*	.069	-.532*	.063	-.310*	--	
X9	.007	-.178*	-.032	-.161*	-.233*	.008	.101*	-.167*	.051	-.046	.084	--
X10	-.843*	.680*	-.452	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

* = Statistically Significant at the .001 Level

survive in tact when multi-variate analysis is introduced. The next step in the analysis are the multivariate models for 1969, 1978, and change between 1969 and 1978.

Table C.4 presents the multivariate analysis of farm scale. A comparison of the two cross-sectional models is of interest. Only three of the independent variables are significantly associated with average farm scale in 1969, yet in 1978 all of the variables are statistically significant. The three variables that were associated at both points in time are 1) labor-saving technology (machinery), 2) dependency upon hired labor, and 3) level of unemployment.

As expected, labor-saving technologies are positively associated with farm scale in both 1969 (B = .306) and 1978 (B = .308). This suggests that counties with a higher investment per farm in labor-saving technologies, also had larger average gross sales. Similarly, counties with a higher dependency upon hired labor were also associated with higher average farm sales in 1969 (B = .440) and 1978 (B = .434). Counties with high levels of unemployment, however, had smaller average farm scale in 1969 (B = -.167) and 1978 (B = -.101).

Table C.4 -- Multivariate Analysis of Average Farm Size - Measured in Gross Annual Sales

Independent Variables	1969/70	1978/80	Change (1970-1980)
Intercept	14856.7* (0)	21341.4 (0)	-3716.41 (0)
Land-Savings Tech. Expenses/Farm	.677 (.103)	.878* (.145)	1.839* (.302)
Average Value of Machinery/Farm	.504* (.306)	.447* (.308)	.220* (.156)
Non-family Labor Expenses/Farm	2.142* (.440)	3.906* (.434)	3.589* (.264)
Percent of Pop. Unemployed	-1422.53* (-.167)	-1487.41* (-.101)	156.626 (.016)
1969 Value of (Average Farm Size in County)	N.A.	N.A.	.485* (.413)
R2	.660	.748	.786

* Statistically significant at the .01 level
Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient shows the relative statistical importance of the variable.

By 1978 the remaining independent variables were significantly associated with average farm scale. Counties with high per farm expenditures on land-saving inputs had larger farms on the average (B = .145).

The analysis of the change model provides some very interesting insights into the role of technology and of hired labor in facilitating farm concentration in the South between 1969 and 1978. Both of the farm technology measures are positively associated with change in farm scale. This would indicate that among counties with the greatest increase per farm in the utilization of land- and labor-saving technologies, there was likely to be a corresponding increase in average farm sales. This is a strong indication of technology facilitating farm concentration. But, what is equally intriguing is that as dependency upon hired labor increases, so too does average scale of farming. This suggests rather forcefully, that concentration during this period was also facilitated by increased dependency upon hired labor (B = .264). Counties with a relatively high average scale of farming in 1969 were the most likely to have greatly increased their scale by 1978 (B = .413).

These three models lend considerable support to the conceptual framework developed in Section 3. The South experienced an increase in the concentration of farms between 1969 and 1978, and that this increase was accomplished by an increase in the per farm use of labor- and land-saving technologies, as well as increased dependency upon hired labor. The findings could be interpreted as evidence that future concentration in farming will be accompanied by workplace changes, changes that will make farming more industrial in character.

Model of Change in Farm Numbers

There is only one model for the dependent variable of farm numbers (Table C.5). This is because farm numbers in cross-sectional analysis is likely to be a function of a county's territorial size and terrain.

Table C.5 presents the multivariate analysis. Three of the independent variables were associated with changing farm numbers, other than the control for time one (i.e., 1969 farm numbers). These were 1) land-saving technologies, 2) change in small farm concentration, and 3) change in the proportion of full-owner operators. The negative association between land-saving technologies and change in farm numbers suggests that in counties where there was more intensive use of land-saving technologies, there was also a large decline in farm numbers. However, as the remaining two variables would indicate, that such a technological association in farm numbers was in part due to structural changes in the concentration of small farms and in full-owner operators. Both other these independent variables were positively associated with change in farm numbers. Therefore, in counties experiencing the greatest decline in the concentration of small farms and/or a sharp decline in full-owner operators, there was likely to be a significant decline in farm numbers. These findings also lend support to the conceptual framework developed in Section 3.

Table C.5 -- Multivariate Analysis of Change in Farm Numbers

Independent Variable	Change 1978-69
Intercept	148.019* (.000)
Land-Saving Tech. Expenses/farm	-.0056* (.099)
Average Value of Machinery/farm	.0006 (.425)
Non-Family Labor Expenses/farm	-.0028 (-.022)
Concentration of Small Farms	1051.000* (.264)
Percent Full-Owner Operator	260.9272* (.158)
Percent of Pop. Unemployed	1.2068 (.013)
1970 Value of Farm Numbers	-.287* (-.824)
R2	.788

* Statistically significant at the .01 level
Regression coefficients are reported with standardized regression coefficients beside in parentheses. A standardized regression coefficient shows the relative statistical importance of the variable.

Part-Time Farming Models

The next set of models examines the phenomenon of part-time farming. Since World War II, and particularly since 1960, there has been a marked increase in the number of farm foamily members who work off the farm. In many instances, part-time farming is a management strategy to aid sagging farm incomes. However, many part-time farms represents efforts by nonfarm people to gain tax advantages, experience farming as an alternative way of life, or simply to be closer to the land. For whatever reason, a general rule of part-time farming is that nonfarm employment opportunities must be relatively closeby.

During the 1970's, nonmentropolitan counties grew at a faster rate than metropolitan counties. This was labeled the "nonmetropolitan turnaround." An important aspect of this change in regional growth patterns was the relocation of many traditionally metropolitan industries in nonmetropolitan areas. Between 1935 and 1965 30 million farm people left farming. For the most part these people did not have the opportunity to enter part-time farming. With the decentralization of manufacturing and service industries into nonmetropolitan counties, the opportunity for part- time farming improved.

Tables C.1 and C.2 present the zero-order correlations for part-time farming in the 1969 and 1978 crossectional analysis. All of the independent variables with the exception of percent of the county unemployed were significantly associated with part-time farming. As with the analysis of average farm scale, there were no differences in the direction of association when 1969 and 1978 are compared. Consequently, the interpretation of associations for both years are the same.

The tables indicate that among counties with a high proportion of operators working 100 or more days off the farm there is a tendency for the average expenditures on land-saving technologies (r = -.544), labor-saving technologies (r = -.541), and nonfamily labor (r = -.465) to be lower. This would suggest, correctly, that part-time farms, as a rule, are relatively small operations. This is support by the positive association of the concentration of small farms with part-time farming (r = .228).

Furthermore, part-time farms are more likely to be full-owner operator farms (r = .690), which indicates the family character of part- time farming. However, tenant farms are strongly and inversely associated with part-time farming, suggesting that this type of farm is unlikely to be characterized by off-farm labor. If the earlier assumptions concerning the hired manager character of the modern measure of tenancy are correct, then it is not surprising that these farms do not have the farm operator working off of the farm.

The commodity variables would indicate that part-time farming is more highly associated with livestock operations (r = .336). Those counties in which grain accounted for a relatively high proportion of agricultural sales were likely to have lower proportions of their farm operators working off the farm (r = -.409).

Table C.3 presents the change values for part-time farming. Those counties with an increase in expenditures for farm chemicals (r = -.172), labor-saving machinery (r = -.130), and nonfamily labor (r = -.115) were least likely to have experienced an increase in part-time farming.

None of the farm workplace variables or the agricultural commodity variables had significant bivariate associations with the percentage of part-time farm operators. However, the 1969 value was negatively associated with change in part-time farming (r = -.452). This suggests that those counties with initially low levels of part-time farming were most likely to have experienced the greatest increases in part-time farming. This seems to reflect the increasing universal character of part- time farming in that those counties with the least occurrence of part-time farming in 1969 would have the largest increases.

Table C.6 presents the multivariate analysis of part-time farming. As with the zero-order correlation analysis, the cross-sectional analyses for 1969 suggest that counties with the highest average expenditures on farm chemicals (B = -.221) were most likely to have a lower proportion of their farm operators working off the farm. The same significant association was found in 1978.

Table C.6 -- Multivariate Analysis of Part-Time Farming

Independent Variables	1969/1970	1979/1980	Change 1980-1970
Intercept	.2302 (.000)	.68832* (.000)	.2139* (.000)
Land-Saving Tech. Expenses/farm	-.000008* (-.221)	-.000004* (-.273)	-.000002* (-.171)
Average Value of Machinery/farm	-3.260 (-.037)	-.000002* (-.400)	-.000001* (-.334)
Non-Family Labor Expenses/farm	.000001 (.089)	.0000001 (.049)	-.0000007 (-.055)
Concentration of Small Farms	-.08195 (-.101)	-.095* (-.122)	.0736 (.070)
Percent Full-Owner Operator	.42876* (.606)	-.0907 (-.086)	-.085* (-.196)
Percent of Pop. Unemployed	-.0027 (-.059)	-.00118 (-.030)	-.0016 (-.067)
1970 Value of Dependent Variable	N.A.	N.A.	-.388* (-.717)
R2	.664	.525	.291

* Statistically significant at the .01 level
Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient shows the relative statistical importance of the variable.

Labor-saving technology provides an interesting example of how the differential emphasis on technology may occur during a decade. In 1969, labor-saving technologies were not associated with part-time farming (B = -.037). However, by 1978 the association had turned rather dramatically with an association of B = -.626. This would suggest that while no substantive association existed regional in 1969, in 1978 counties with high per capita expenditures on labor saving technologies were unlikely to have high levels of part-time farming. This finding is in contrast to those for full-owner operator farms. In 1969, there was a strong association between the proportion of full owner-operators in a county and part-time farming (B = .606). However, in 1978 the association was not significant (B = -.086). The ascendency of labor-saving technologies and the decline in importance of full-owner operators is consistent with the earlier explanation of the full-owner association with farm scale.

The other measure of farm structure to be significant in the cross- sectional analysis was the level of small farm concentration. In both 1969 (B = -.101) and 1978 (B = -.122) this variable was significantly and negatively associated with the level of part-time farming. For both points in time, counties with high concentrations of small farms tended to have low levels of part-time farming, when controlling for land- and labor-saving technologies. However, when the agricultural technologies are eliminated from the model, in 1978 there is a positive association B = .150), which would indicate that as farm concentration increases, so too does part-time farming (the data for this analysis is not presented here). Similarly, when the technology variables are not included, the dependency upon hired labor emerges as a strong predictor of part-time farming in 1978 (B = -.535). This would indicate that counties with a high dependency on hired labor were not likely to have a high proportion of part-time farmers. This further indicates that where farms with high dependencies on hired labor occur, with their larger-than-family and industrial-type farm structures, part-time farming is not likely to be important. This might suggest that in the future, counties that take on an industrial farming hinterland, will not be characterized by a relatively large number of part-time farmers.

The association among the change scores for part-time farming are equally interesting. When land- and labor-saving technologies are included in the model, both have relatively strong negative associations with part- time farming (B = -.171, B = -.334 respectively). This would indicate that counties with substantial increases in both types of technologies were not likely to have experienced little increase, if not a decline, in part-time farming. The expansion of larger farms utilizing land- and labor-saving technologies appears to be negatively associated with the emergence of part- time farming. This might indicate that where industrial-type and larger- than-family farming operations are dominant, the opportunities for part- time farming are lower (for any of a number of reasons, including few off- farm opportunities).

When the agricultural technologies are not included in the model, then change in labor dependency (B = -.172), change in small farm concentration (B = .197), and change in full-owner operators (B = -.324) register substantive significance with the occurrence of part-time farming (full- owner also is substantively associated even with technology controlled for). These findings, which are not reported in any tables, suggests that counties where there was a shift to greater dependency upon hired labors were associated with a loss of dependency on part-time farming. Furthermore, counties with an decline in the concentration of small farms were also likely to have a decline in part-time farming.

The results for full-owner farms again appears to be anomalous. However, given the historical character of tenancy, a further loss of the old tenant system among the agriculturally marginal counties might explain the negative relationship. Therefore, the proportion of full-owner farms may increase due to the loss of tenant farms rather than an increase in full-owners.

Analysis of County Quality of Life

Six dependent variables representing different dimensions of the quality of life in a county are examined in this report: (1) median family income, (2) percent of families below poverty, (3) percent of working population that is unemployed, (4) population of a county, (5) number of retail establishments, and (6) property taxes per capita. The first three variables are discussed in Section 5 in some detail. In this appendix only the last three variables are examined. As with the farm structure models, both bivariate and multivariate analysis is reported. The most prominent zero-order correlations are reported, but the focus of the analyses is upon the multivariate models. Tables C.7, C.8, and C.9 present the zero-order correlations for all six dependent variables.

Population Size

As with the number of farms, population size can be a function of geographical characteristics. But some of the correlations are worth noting. Counties with the largest populations, and therefore likely to have a larger resource base, tend to have a lower percentage of families in poverty (r = -.390) and a higher level of median family income (r = .476) in 1970. A similar bivariate association exists in 1980. In addition, in both 1970 (r = -.253) and 1980 (r = -.289) the percent of the farm population of the rural population in a county is lower in the counties with the largest populations.

Table C.9 gives the zero-order correlations for the change values. Those counties in which the percent of families in poverty declined also experienced an increase in population during the decade (r = .215). Similarly, in counties where the number of retail establishments increased, so too did the population (r = .643). While the number of retail establishments was not used an independent variable, the association with population change would indicate that counties experiencing decline also had a corresponding decline in the number of viable retail establishments.

Only one farm variable had a significant bivariate association with population change, the percent of the farm population of the total rural population (r = .142). This association, while relatively weak, suggests that in counties where the farm population declined, so too did the county population.

Both the percent of manufacturing and service industries were significantly associated, but in different directions. As the percent of the county's labor force in manufacturing increased during the decade, the county's population was likely to decrease (r = -.161). However, as the county's service industries gained in proportion, the county was likely to increase in population (r = .130). However, neither association was particularly strong.

Table C.7: Zero-Order Correlations: Cross-Sectional Analysis of Community Well-Being 1970

Y1	County Population	X2	Concentration of Small Farms
Y2	Percent of Families in Poverty	X3	Percent Part-Time Farms
Y3	Medium Family Income	X4	Percent Farm Pop. of Rural Pop.
Y4	Percent Unemployment	X5	Percent Manufacturing
Y5	Number of Retail Establishments	X6	Percent Service Industry
Y6	Property Tax Per Capita	X7	Proximity to SMSA
X1	Average Farm Size		

	Y1	Y2	Y3	Y4	Y5	Y6	X1	X2	X3	X4	X5	X6	X7
Y1	--												
Y2	-.39*	--											
Y3	.47*	-.91*	--										
Y4	.07	.39*	-.43*	--									
Y5	.95*	-.35*	.41*	.10*	--								
Y6	.17*	-.43*	.45*	.09	.20*	--							
X1	.04	-.04	.12*	-.14*	.07	.25*	--						
X2	.27*	-.11*	.05	.04	.25*	-.16*	-.44*	--					
X3	.03	-.32*	.30*	-.04	-.02	.01	-.46*	.23*	--				
X4	-.25*	.21*	-.35*	.03	-.20*	-.17*	-.09	.09	-.46*	--			
X5	-.01	-.37*	.32*	-.29*	-.01	-.07	-.10	.13*	.35*	-.09	--		
X6	.07	.17*	-.07	-.06	.10*	.09	.27*	-.33*	-.18*	-.18*	-.32*	--	
X7	-.71*	.39*	-.49*	.14*	-.68*	-.17*	-.10	-.08	-.08	.15*	-.05	-.17*	--

* = Statistically Significant at the .01 Level

Table C.8: Zero-Order Correlations: Cross-Sectional Analysis of Community Well-Being in 1980

Y1	County Population
Y2	Percent of Families in Poverty
Y3	Medium Family Income
Y4	Percent Unemployment
Y5	Number of Retail Establishments
Y6	Property Tax Per Capita
X1	Average Farm Size
X2	Concentration of Small Farms
X3	Percent Part-Time Farms
X4	Percent Farm Pop. of Rural Pop.
X5	Percent Manufacturing
X6	Percent Service Industry
X7	Proximity to SMSA

	Y1	Y2	Y3	Y4	Y5	Y6	X1	X2	X3	X4	X5	X6	X7
Y1	--												
Y2	-.36*	--											
Y3	.43*	-.82*	--										
Y4	-.17*	.45*	-.46*	--									
Y5	.96*	-.33*	.37*	-.17*	--								
Y6	.08	-.33*	.43*	-.32*	.12*	--							
X1	.05	.09	.03	-.30*	.10*	.26*	--						
X2	.24*	-.21*	.06	.20*	.23*	-.15*	-.46*	--					
X3	.03	-.35*	.23*	.09	-.02	-.08	-.60*	.40	--				
X4	-.29*	.21*	-.29*	.05	-.24*	-.10*	.03	-.40	-.35*	--			
X5	-.05	-.18*	-.02	-.25*	-.02	-.04	-.03	.11*	.19*	.05	--		
X6	.18*	.10	.02	.10*	.14*	-.03	-.02	-.04	.01	-.21*	-.50*	--	
X7	-.70*	.31*	-.43*	.22*	-.67*	-.11*	-.12	-.06	-.06	.16*	-.03	-.18*	--

* = Statistically Significant at the .01 Level

Table C.9: Zero-Order Correlations: Change Analysis of Community Well-Being Between '70 and '80

Y1	County Population	X2	Concentration of Small Farms
Y2	Percent of Families in Poverty	X3	Percent Part-Time Farms
Y3	Medium Family Income	X4	Percent Farm Pop. of Rural Pop.
Y4	Percent Unemployment	X5	Percent Manufacturing
Y5	Number of Retail Establishments	X6	Percent Service Industry
Y6	Property Tax Per Capita	X7	Proximity to SMSA
X1	Average Farm Size	X8	Change in Farm Numbers

	Y1	Y2	Y3	Y4	Y5	Y6	X1	X2	X3	X4	X5	X6	X7	X8
Y1	--													
Y2	.21*	--												
Y3	.07	-.55*	--											
Y4	-.05	-.01	-.17*	--										
Y5	.64*	.24*	-.10	.06	--									
Y6	.04	.10*	.03	-.06	.14*	--								
X1	-.07	-.01	-.03	-.18*	-.03	.12*	--							
X2	.08	.14*	-.08	.10*	.13*	.08	-.29*	--						
X3	-.001	-.12*	.15*	-.03	-.05	-.08	-.17*	.08	--					
X4	.14*	.11*	.08	-.12*	.08	.09	.05	.17*	-.19*	--				
X5	-.16*	-.17*	-.02	-.02	-.13*	-.08	.23	-.08	.12*	-.26	--			
X6	.13*	.01	-.01	.05	.08	-.12*	-.21*	.05	-.00	-.01	-.22*	--		
X7	-.49*	-.36*	.07	.12*	-.26*	.01	-.12*	.05	.02	-.11*	.05	-.07	--	
X8	-.23*	.01	.06	.01	-.14*	.10*	-.09	.39*	-.06	.40*	-.16*	.01	.28*	--

* = Statistically Significant at the .01 Level

The multivariate model presented in Table C.10 indicates that only four independent variables were associated with population size for both cross-sectional analyses: concentration of small farms (B = .299, B = .317), percent part-time farms (B = -.205, B = -.209), percent of the farm population of the total rural population (B = -.299, B = -.250), and proximity to an SMSA (B = -.649, B = -.627).

Table C.11 -- Multi-variate Analysis of Population in 1970, 1980 and Change Between 1970 and 1980.

Independent Variables	1969/70	1979/80	Change 1980-1970
Intercept	82463.17* (0.00)	! 97355.57* (0.00)	-212.522 (0.00)
Change in Farm Numbers	NA	NA	-0.455 (-0.022)
Average Farm Size - Sales	0.012 (0.012)	-0.009 (0.014)	-0.014 (-0.061)
Concentration of Farms	42780.29* (0.299)	53208.75* (0.317)	17293.91* (0.18)
Percent Part-Time Farm	-37266* (-0.205)	-45231.1* (-0.209)	1711.705 (0.020)
Percent Farm of Rural Pop.	-45250.1* (-0.299)	-77690.4* (-0.250)	-1921.85 (-0.029)
Percent In Manufacturing	-6235.44 (-0.040)	-12318.1 (-0.063)	-8665.62* (-0.093)
Percent in Service Ind.	-27208.7 (-0.042)	4927.821 (0.010)	448.820 (0.005)
Percent of Pop. Unemployed	-129.523 (-0.015)	-635.482 (-0.077)	6.774 (0.003)
Proximity to SMSA	-8648.11* (-0.649)	-9875.55* (-0.627)	50.662 (0.016)
1970 Value for Dependent Var.	NA	NA	0.175* (0.723)
R2	0.616	0.612	0.532

* Statistically significant at the .01 level
Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient shows the relative statistical importance of the variable.

The model for change values is of the most interest to this study. Only three independent variables were associated with population change: (1) concentration of small farms (B = .187), (2) percent of labor force in manufacturing (B = -.093), and (3) initial population size (B = .723). The concentration of small farms association is interesting. It suggests that as the concentration of small farms declines, so too does the counties population, thus indicating that the loss of small farms may contribute to population loss. The manufacturing variable offers some insights contrary to popular opinion. Among counties experiencing an increase in manufacturing as a proportion of the labor force, there was a tendency for there population to decline between 1970 and 1980.

The control variable for initial size indicates that among the South nonmetropolitan counties with the largest populations in 1970, there was a likelihood that these counties would have that largest population increases, which is not surprising.

Number of Retail Establishments

The second dependent variable, number of retail establishments, was included as a measure of the viability of local retail trade and its correlates. Four independent variables were associated with the dependent variable in 1970: (1) concentration of small farms (r = .253), (2) percent of the farm population of the rural population (r = -.204), (3) percent of service industry (r = .101), and (4) proximity to a larger place (r = -.07). Each of these independent variables had similar associations in 1980. An additional variable, average farm size, was positively associated with the number of retail establishments in 1980.

Table C.11 presents the multivariate associations. In 1970, three of the farm variables were associated with the retail establishments: (1) average farm sales (B = .147), (2) percent of part-time operators (B = .198), and (3) percent of farm population as a percent of the rural population (B = -.200). Counties with a high average farm scale and/or with a high proportion of part-time farm operators in 1970 were likely to have a high number of retail establishments. Counties with a low proportion of farm people of the rural population were likely to have more farms.

In 1980 only two farm variables were associated with retail establishments: (1) percent of part-time operators (B = .270) and (2) percent of farm people of rural people (B = -.141). Since the directions of the associations are the same as 1970, similar interpretations can be made.

Only three of the independent variable change values were significant with change in the number of retail establishments: (1) change in farm concentration (B = .201), (2) percent manufacturing (B = -.116), and (3) the initial number of retail establishments in 1970 (B = .371).

Table C.11: Multi-variate Analysis of the Number of Retail Establishments in 1970, 1980, and Change Between 1970 and 1980.

Independent Variables	1969/70	1979/80	Change 1980-1970
Intercept	20798.3* (0.00)	27034.79* (0.00)	-14.863 (0.00)
Change in Farm Numbers	NA	NA	-0.017 (-0.078)
Average Farm Size - Sales	0.024* (0.147)	0.001 (0.011)	-0.000 (-0.007)
Concentration of Farms	-22.385 (-0.001)	1100.333 (0.047)	189.604* (0.201)
Percent Part-Time Farm	5698.45* (0.198)	8236.305* (0.270)	-37.033 (-0.042)
Percent Farm of Rural Pop.	-4764.01* (-0.200)	-6160.73* (-0.141)	2.481 (0.004)
Percent In Manufacturing	1841.86 (0.075)	-7160.78* (-0.260)	-109.829* (-0.116)
Percent in Service Ind.	-18656.2* (-0.180)	-10108.7* (-0.148)	43.097 (0.045)
Percent of Pop. Unemployed	-407.417* (-0.306)	-543.924* (-0.467)	1.720 (0.084)
Proximity to SMSA	-844.340* (-0.401)	-681.488* (-0.308)	-0.182 (-0.006)
1970 Value for Dependent Var.	NA	NA	0.095* (0.371)
R2	0.516	0.443	0.207

* Statistically significant at the .01 level
Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient shows the relative statistical importance of the variable.

The farm variable is of interest. This positive association suggests that as the number of small farms decline so too does the number of retail establishments. This is consistent with the Goldschmidt hypothesis that farm concentration is likely to lead to a decline in the number of local retail establishments.

Property Taxes Per Capita

Property taxes per capita have been included as an indirect measure of a local society's ability to provide essential public services. This variable has some measurement difficulty, since property taxes do not necessarily represent all of the tax base of local societies. Four independent variables had a significant bivariate association with the dependent variable in both 1970 and 1980: (1) average farm scale, (2) concentration of small farms, (3) percent of the farm population of the rural population, and (4) proximity to a larger place.

The two farm variables are of interest. For both years, county's which higher average farm sales were more likely to have higher property taxes per capita. However, county's with a higher concentration of small farms were more likely to have a lower property tax.

The multivariate analysis is presented in Table C.12. As with the bivariate analysis, average farm scale is positively associated with property taxes per capita for both 1970 (B = .222) and 1980 (B = .191). But, concentration of small farms does not hold up under multivariate analysis. Nonetheless, the positive association between average farm scale and property taxes per capita is counter to the Goldschmidt hypothesis, in that counties with the larger farms are also likely to have a higher local revenue for public services than counties dominated by small farms.

In 1970, the percent of the farm population of the rural population was negatively associated with property taxes per capita (B = -.13), indicating that counties in which the rural population was more dependent upon farming had lower property taxes.

The percent of a counties labor force employed in manufacturing was negatively associated with property taxes per capita in both 1970 (B = -.167) and 1980 (B = -.172). This suggests that in counties with a high proportion of their labor force in manufacturing, the property taxes per capita is likely to be low. This would indicate that counties in the past could not count on manufacturing interests to help increase their ability to raise local revenue. Similarly, in 1970 the percent of the labor force in service industries was negatively associated with property taxes per capita (B = -.122).

Only two independent change variables were associated with change in property taxes: (1) average farm size (B = .143) and (2) concentration of small farms (B = .131). This indicates that during the decade counties in which the average farm scale increased were likely to have property taxes per capita increases as well. Also, in counties where the concentration of small farms declines, property taxes per capita were likely to decline as well.

It is noteworthy that it was two farm variables that were associated with property tax changes. It is also noteworthy that change in manufacturing employment or service employment were not associated with improved property taxes per capita.

Table C.12: Multivariate Analysis of Property Taxes Per Capita in 1970, 1980, and Change Between 1970 and 1980.

Independent Variables	1969/70	1979/80	Change 1980-1970
Intercept	185.935* (0.00)	229.033* (0.00)	49.681* (0.00)
Change in Farm Numbers	NA	NA	0.012 (0.052)
Average Farm Size - Sales	0.001* (0.222)	0.000* (0.191)	0.003* (0.143)
Concentration of Farms	-34.354 (-0.100)	-11.550 (-0.022)	137.787* (0.131)
Percent Part-Time Farm	34.931 (0.080)	52.794 (0.078)	-82.986 (-0.085)
Percent Farm of Rural Pop.	-45.804* (-0.127)	-71.177 (-0.073)	-0.034 (-0.000)
Percent In Manufacturing	-61.795* (-0.167)	-105.571* (-0.172)	-102.849 (-0.096)
Percent In Service Ind.	-191.349* (-0.122)	-151.098 (-0.100)	-110.531 (-0.104)
Percent of Pop. Unemployed	-2.651* (-0.132)	-7.197* (-0.277)	-1.187 (-0.052)
Proximity to SMSA	-4.468* (-0.146)	-1.244 (-0.025)	0.542 (0.015)
1970 Value for Dependent Var.	NA	NA	-0.061 (-0.053)
R2	0.154	0.154	0.062

* Statistically significant at the .01 level

Regression coefficients are reported with standardized regression coefficients beneath in parentheses. A standardized regression coefficient shows the relative statistical importance of the variable.

REFERENCES

Bender, Thomas
1978 Community and Social Change in America. New Brunswick, NJ: Rutgers University Press.

Billings, Dwight B.
1979 Planters and the Making of a New South. Chapel Hill, NC: University of North Carolina Press.

Bonnano, Alessandro
1985 The Persistence of Small Farms in Advanced Western Socieities. Unpublished Ph.D. Dissertation, Universtiy of Kentucky.

Bradshaw, Ted K., and Edward J. Blakely
1983 National, State, and Local Roles in Rural Policy Development. The Rural Sociologist Vol 3(4):212-219.

Christaller, Walter
1966 Central Places in Germany. Englewood Cliffs, NJ: Prentice-Hall.

Cochrane, Willard
1979 The Development of American Agriculture. Minneapolis: University of Minnesota Press.

Coughenour, C. Milton, and Louis Swanson
1983 "Work statuses and occupations of men and women in farm families and the structure of farms." Rural Sociology 48(1):23-43.

Coughenour, C. Milton, Louis E. Swanson, and Ann Stockham
1983 "Kentucky Farmers, 1982." Community Issues. Department of Sociology, College of Agriculture, University of Kentucky, Vol. 5, No. 2.

Daniel, Peter
1985 Breaking The Land. Champaign, Illinois: University of Illinois Press.

Davis, John E.
1980 "Capitalist agricultural development and the exploitation of the propertied laborer." Pp. 133-153 in Frederick Buttel and Howard Newby (eds.) The Rural Sociology of Advanced Societies. Montclair, N.J.: Allanheld, Osmun.

Dillman, Don A.
1983 "How a national rural policy can help resolve rural problems." The Rural Sociologist. Vol. 3 (6):379-383.

Flora, Jan, Ivan Brown, and J. L. Conboy
1979 "Impact of Type of Agriculture on Class Structure and Social Well-being in the Great Plains." Paper presented at the annual meeting of The Rural Sociological Society, Madison, Wisconsin.

Forsht, R. Gar, and Dean Jansmd
1975 Economic and Population Growth in Smaller Place Areas of Pennsylvania. Washington, D.C., United States Department of Agriculture, Agricultural Economic Report No. 310.

Fujimoto, Isao
1977 "The Communities of the San Joaquin Valley," in U.S. Congress, Senate, Priorities in Agricultural Research of The U.S. Department of Agriculture--Appendix. Subcommittee on The Judiciary, 95th Contress, 2nd Session, Part 2, pp. 1374-1396.

Genovese, Eugene D.
1965 The Political Economy of Slavery: Studies in the Economy and Society of the Slave South. New York: Vintage Books.

Goldschmidt, Walter
1978 As You Sow. New York: Harcourt, Brace.

Goss, Kevin F. and Richard B. Rodefeld
1978 "Consequences of Mechanization in U.S. Agriculture, 1935-1975." Paper presented at the annual meetings of the Rural Sociological Society at San Francisco, August.

Goss, Kevin F.
1978 "Agricultural Change and Rural Community Change." Unpublished Paper, Pennsylvania State University.

Goss, Kevin F.
1979 "Goldschmidt. As You Sow: Three Studies in the Social Consequences of Agribusiness." Rural Sociology 44(4):802-805.

Hahn, Steven
1983 The Roots of Southern Populism: Yeoman Farmers and the Transformation of the Georgia Upcountry, 1850-1890. New York: Oxford University Press.

Hayes, Michael N., and Alan L. Olmstead
1984 "Farm Size and Community Quality: Arvin and Dinuba Revisited. American Journal of Agricultural Economics, 66(4):430-436.

Heffernan, William
1984 "The structure of poultry farms." In Harry Schwartzweller (ed.), Annual Review of Rural Sociology and Development Volume 1. New York: JAI Press.

Heinz, F. K., D. L. Brown, and J. M. Zimmer
1975 Social and Economic Characteristics of the Population in Metropolitan and Nonmetropolitan Counties in 1970. Washington, D. C., Economic Research Service, Agricultural Economics Report 272.

Henretta, James A.
1978 "Families and Farms: Mentalite in Preindustrial America." William and Mary Quarterly 35(1):3-32.

Horan, Patrick M., and Charles M. Tolbert II
1984 The Organization of Work in Rural and Urban Labor Markets. Boulder, Co.: Westview Press.

Kirby, Jack Temple
1983 "The Transformation of Southern Plantations, 1920-1960." Agricultural History 57(3):257-76.

McArthur, W. C.
1979 "The South." Pp. 303-334 in Lyle P. Schertz, Another Revolution in U.S. Farming? Washington, D.C.: U.S. Department of Agriculture.

MacCannell, Dean, and Edward Dolber-Smith
1985 "Report on the structure of agriculture and impacts of new technologies on rural communities in Arizona, California, Florida and Texas." Paper prepared for the Office of Technology Assessment, U.S. Congress.

Mandle, Jay R.
1978 The Roots of Black Poverty: The Southern Plantation Economy After The Civil War. Durham, NC: Duke University Press.

Mann, Susan
1984 "Sharecropping in the Cotton South: A Case of Uneven Development of Agriculture." Rural Sociology 49(3):412-29.

Munzo, Robert, and William Flinn
1977 "Factors Related to Small Town Growth and Decline in Ohio, 1930 to 1970." Paper presented at the annual meetings of The Rural Sociological Society at Burlington, Vermont, August.

Petterson, Steve
1977 The Family Farm: A California Small Farm Visability Project. Technology Task Force Report, Appendix A, November.

Pryor, Frederick L.
1982 "The Plantation Economy as an Economic System." Journal of Comparative Economics 6(September):288-317.

Rodefeld, Richard D.
1974 The Changing organizational and Occupational Structure of Farming and the Implications for Farm Work Force Individuals, Families and Communities. Unpublished Dissertation, Madison: University of Wisconsin.

Rogers, George B.
1979 "Poultry and eggs." Pp. 148-189 in Lyle P. Schertz, Another Revolution in American Agriculture. Washington, D.C.: U.S. Department of Agriculture.

Rosenberg, Nathan
1982 Inside The Black Box: Technology and Economics. New York: Cambridge University Press.

Sargen, Nicholas P.
1979 Tractorization in the United States and Its Relevance for the Developing Countries. New York: Garland Press.

Shertz, Lyle P.
1979 Another Revolution in American Agriculture? Washington, D.C.:U.S. Department of Agriculture.

Shlomowitz, Ralph
1984 "Plantations and Small Holdings: Comparative Perspectives From The World Cotton and Sugar Cane Economies, 1865-1939." Agricultural History 58(1):1-16.

Starbird, Irving R. and Kieth J. Collins
1983 What Does the Future Hold? Memphis: Meister Publishing Company.

Summers, Gene F.
1979 "Manufacturing and Rural Development: Thoughts on a Reserach Program." In Eldon D. Smith (ed.), Rural Industrialization: A Monograph. Mississippi State: Southern Rural Development Center.

Summers, Gene F., Sharon D. Evans, Frank Clemente, E. M. Beck, and Jon Minkoff
1976 Industrial Invasion of Nonmetropolitan America. New York: Praeger Publishers.

Swanson, Louis E., Jr.
1982 Farm and Trade Center Transition in an Industrial Society: Pennsylvania, 1930-1960. Unpublished Dissertation, University Park: Pennsylvania State University.

Thigpen, John R. III
1984 "Agriculture in Low-Income southern Counties." Paper presented at the Southern Association of Agricultural Scientists annual meetings. Nashville, Tennessee, Feburary.

Vandivere, Joseph S.
1978 "The Changing Realm of King cotton." PP. 242-246 in Rodefeld, Richard, Jan Flora, Donald Voth, Isao Fujinuoto, Jim Converse (eds.), Change in Rural America: Causes, Consequences, and Alternatives. St. Louis, MO: The C. V. Mosby Company.

Warren, Roland
1978 The Community in America (3rd Edition). New York: Rand McNally and Company.

Weber, Max
1947 The Theory of Social and Economic Organization. New York: Knoff.

Whiting, Edward (ed.)
1974 Communities Left Behind: Alternatives for Development. Ames, Iowa: Iowa State University Press.

Wilkinson, Kenneth P.
1984 "Implementing & National Strategy of Rural Development." The Rural Sociologist Vol. 4, (5):348-353.

Wilkinson, Kenneth P., Daryl J. Hobbs, and James A. Christenson
1983 An Analysis of the National Rural Development Strategy." The Rural Sociologist. Vol. 3, (6):384-389.

Winkler, Kelly M.
1984 "USDA Outlines Rural Development Policy." The Rural Sociologist Vol. 4, (4):316.

Background Paper No. 6

Agricultural Technologies, Farm Structure, and Rural Communities in the Cornbelt: Policy Choices and Implications for 2000

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AGRICULTURAL TECHNOLOGIES, FARM STRUCTURE AND RURAL COMMUNITIES IN THE CORNBELT: POLICIES AND IMPLICATIONS FOR 2000

INTRODUCTION

Agriculture is often referred to as the main economic activity of rural America and in certain respects the hegemony of agriculture in rural areas cannot be challenged. Historically, except in those few locations where extractive industry or trade dominated, agriculture has been the foremost economic activity in rural areas. This historical dominance has had a strong impact on the culture and institutions of rural areas.

Even now, agriculture is the dominant user of space in most rural areas, and even though the number of farmers may be small their activities are always very visible. Finally, agriculture is an important economic activity in most rural areas and is characterized by cyclical ups and downs because of strongly fluctuating market prices and inconsistent weather patterns. The sometimes violent swings of the farm economy that may not coincide with the general business cycle give agriculture great notoriety as a local economic factor. The farm financial crisis of the 1980s is an example of the volitility of the farm economy and the significance of a healthy agricultural sector for the general well-being of rural economies.

The general objective of this paper is to investigate the impact of changes in agricultural structure on rural communities. In the 1940s Goldschmidt (1978) studied two communities in California and determined that a large scale, more concentrated agricultural structure was associated with a numberof delitimous effects on the well-being of rural communities. Subsequent research (Sonka and Headly, 1974; Tweeten, 1984) tends to confirm that the nature of the structure of agriculture has an impact on local communities, as well as on numerous other items, such as the value of agricultural exports, the price of food and the income obtained per farm. As Tweeten (1984) points out:

> In short, consumers pay more for food, but rural communities are favored with a superior social and economic base under a system of small farms. Such as system would require considerable off-farm employment to supplement limited income per unit from farm sources (Tweeten, 1984:50).

Declining numbers of farmers has its repercussion in the community through the loss of employment in the community service sector: teachers, ministers, retail store employees are likely to loose employment if the farm base declines in numbers. However, as noted above, smaller scale farms are usually associated with lower income per family and thus by themselves do not provide for enhanced community health.

Furthermore, many changes other than those taking place in agriculture affect rural communities in contemporary rural areas, the importance of agriculture varies, sometimes dramatically, by location. Numerically, farmers and their families are almost always outnumbered by other residents. Economically, although in many communities farming still contributes substantially to local income, few communities depend solely on agriculture. During the previous decades non-agricultural employment in rural areas has grown substantially, as has the nonmetropolitan population.

> Rural communities have shown remarkable vitality in the face of declining farm employment. Industries have located or expanded in rural areas to utilize underemployed labor freed from farming. In the 1970s, employment and population grew more rapidly in rural communities than in metropolitan communities. The well documented demographic transition is characterized by employment and population growth not only in counties adjacent to metropolitan counties but also in hinterland counties.... (Tweeten, 1984:51).

United States Department of Agriculture economist Bluestone has also argued that during the recent decades rural economies have become dominated by manufacturing, construction, and service-producing industries. Although Bluestone expects employment growth in the rural and small town communities to lag behind the growth in metropolitan areas in the future, Bluestone argues that:

> ... rural employment growth during the 1980s will probably be more rapid than in the three decades following 1940, when nonmetro areas were adjusting to the large job losses in agriculture and other natural resource industries (Farmline, 1985).

Certainly, future changes will not take place uniformly throughout the country and rural communities will be affected in varying degrees.

The paper is organized as follows: first a brief review of the history of change in American agriculture, focusing on the structure of agriculture and the changes that have taken place nationally and in the North Central Region is presented. Subsequently, analyses will focus on the rural counties in the Cornbelt area, specifically those dominated by grain, dairy or mixed agricultural enterprises in order to make judgement on the likely impact of changes in the structure of agriculture on rural communities. Finally, a discussion of the implications for rural communities of future technological changes in production agriculture is given.

Structural Change and Technology

For the purposes of this paper it is important to sharply distinguish between changes in the structure of agriculture and general changes in the farm economy and other sectors important in rural areas. The purpose of this paper is not to study the overall importance of agriculture to the economic viability of rural communities or the impact of the farm financial crisis of the mid-1980s or federal commodity program changes on rural communities. Rather, the objective is to analyze the likely consequences of changes in the structure of agriculture, driven by technology, on the well-being of rural communities in the Cornbelt. The ability of the analysis to effectively measure farm structure and to identify those community characteristics associated with structural change are limited by available data and conceptual frameworks. While sudden changes in federal commodity programs or the current farm financial crisis may severly impact rural communities, such changes are not the direct result of technologically induced changes in the structure of agriculture. The impacts of the farm financial crisis and federal commodity program changes on rural communities are important issues, but are outside the intent of this paper and beyond the scope of the project to which this paper contributes. One basic assumption of this analysis is similar regional and agricultural economic conditions under various alternative structures. It is expected that with continued weak economic conditions in agriculture, the impact of technology on farm structure and consequently rural commmunities would accelerate and aggregate existing trends in the economy. One implication of the interaction of weaken economic conditions and advancing technologies is that any social and economic adjustments will be accelerated. A strong farm economy with advancing technologies may allow for a slower rate of adjustment. The focus of this paper, however, is on isolating the association between farm structure and community well-being, assuming similar underlying economic conditions.

DEFINITION OF AGRICULTURAL STRUCTURE

Agricultural structure is not a well-defined concept (Penn, 1979), but most authors refer to agricultural structure in terms of the organization of, and control over, agricultural resources and production. Certain authors have referred to the structure of agriculture in terms of the existence of certain types of farms such as family farms or corporate farms. However, the most common concerns with the strucuture of agriculture deal with the distribution of farms within agriculture in terms of their access to resources, their ability to support the farm operator economically, and the consequences of such distribution for agricultural production and agricultural communities. While not entirely acceptable, the structure of agriculture will be measured by the distribution of farm size in agriculture. It is recognized size may not always be a good proxie for structure, but with data and resource limitations it is used in this study.

No commonly accepted definition of size of farm exists, but the two most commonly used definitions define farm size either in terms of the amount of farm sales or in terms of acres operated. Farm sales, when the information can be related to expenditures, provides a better measure of the ability of farms to support the operator economically. However, no national statistics are available which provide good sales and expenditure measures.

Number of acres on a farm provides a measure of size that is very dependent on such agronomic considerations as soil productivity and type of enterprise. However, within regions where agricultural conditions are similar, acreage is a measure which provides useful information on the number and size distribution of farms. For purposes of this discussion, the trends in numbers of farms adequately represent the changes in agricultural structure in the United States.

HISTORICAL DEVELOPMENTS

Number of Farms

The number of farms by regions in the United States shows a historical pattern that reflects the major forces operating in agriculture. Until the first decades of the twentieth century the number of farms in the United States grew, reflecting the westward expansion and the increased settlement of the United States, especially in the Central states (see Figure 1). Only the Pacific region (Washington, Oregon, and California) grew in number of farms after 1930 and only for one additional decade. In the national picture, the numerically small growth in the Pacific states did not affect the overall trend towards declining farm numbers during the thirties and thereafter.

It should be noted that the decline in farm numbers is not a recent phenomenon. Farm numbers have been declining for a half a century or more in all but one region, including periods of decline of more than a century in New England and the Middle Atlantic region (see Figure 1).

The decline in the New England and Middle Atlantic states is not only of longer duration it has also proceeded further than has been the

FIGURE 1

Number of Farms (in 1,000's)
by Region

Number of U.S. Farms by Region, 1850-1978

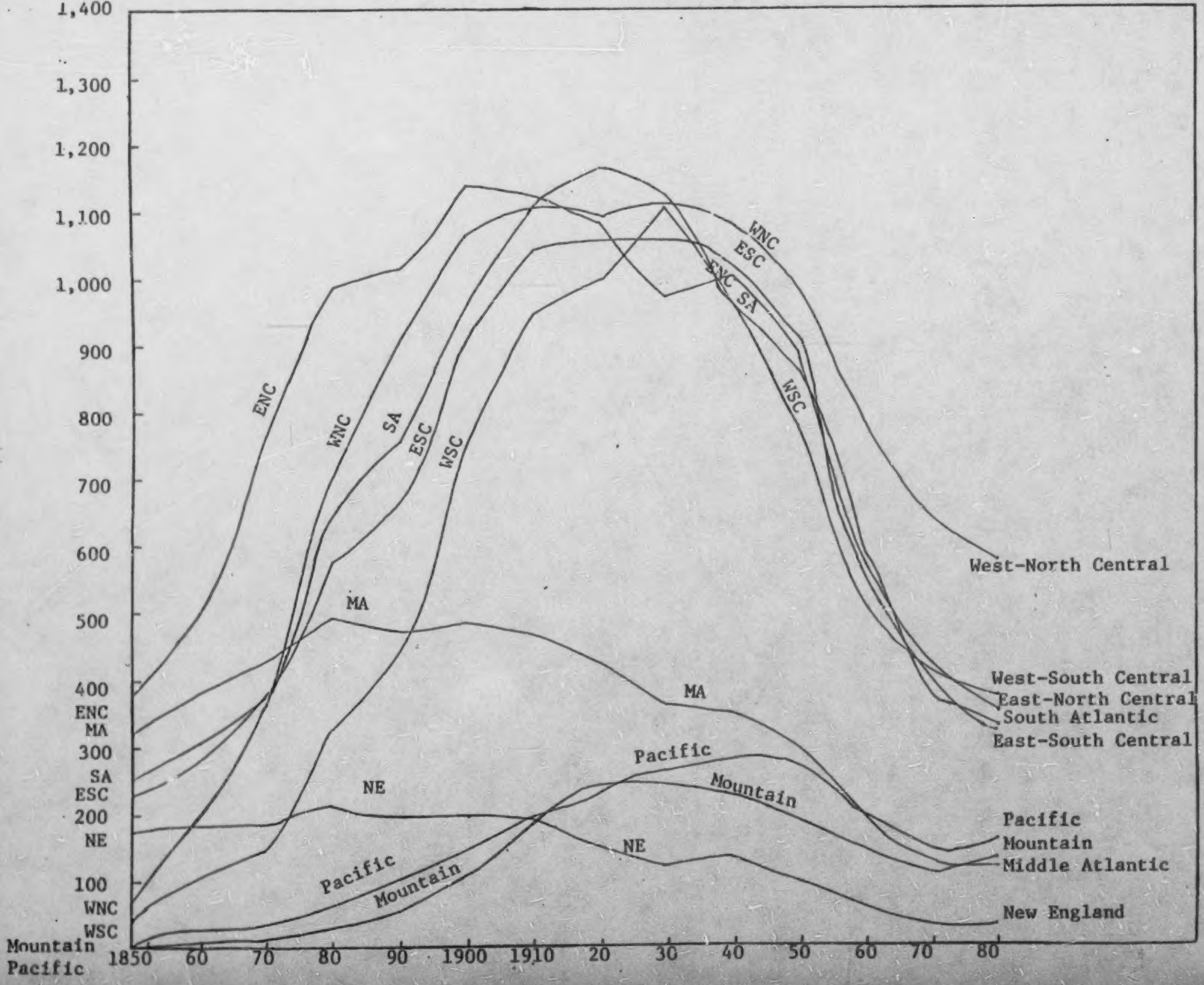


Table 1. Decline in Number of Farms Since Highest Count Year For Regions of the United States

Region	Year of Highest Number	Highest Number	1978 Number	1978 as Percent of Highest Number
New England	1880	207,232	30,036	14.5
Middle Atlantic	1880	488,907	119,110	24.4
East North Central	1900	1,135,823	452,470	39.8
South Atlantic	1920	1,158,976	352,273	30.4
Mountain	1920	244,109	127,698	52.3
West South Central	1930	1,103,134	371,330	33.6
East South Central	1930	1,062,214	318,701	30.0
West North Central	1930	1,112,755	575,253	51.7
Pacific	1940	276,173	158,771	57.5

case in the other states (see Table 1). The degree of the decline in farm numbers is most pronounced in the East and gradually diminishes toward the West. New England's contemporary farm numbers account for less than 15 percent of the highest number it attained in 1880. The reductions in numbers have been least pronounced in the West North Central, Mountain, and Pacific regions. These are the regions in which the growth of farms has started later, and in general the average farm size has been somewhat larger.

A second interesting fact can be derived from Figure 1. The four regions with small numbers of farms show either an upturn in numbers between 1970 and 1980 (New England, Pacific, Mountain) or essentially a stable situation (Middle Atlantic). For all other regions the rate of decline for the period 1970-1980 is substantially less than for previous time periods indicating that in those regions the farm numbers are declining more slowly.

The growth in farms until early in the twentieth century was accompanied by a similar increase in acres farmed (see Table 2). By 1930 decline in farm numbers had commenced, while total acreage in farms continued to grow for several decades. During the last three decades acreage in farms has decreased by more than one million acres, but the rate of decline in numbers of farms has always been larger than the rate of decline in land in farms. One of the results has been, of course, the well-known growth in average farm size.

Distribution of Farms by Size

The decline in number of farms has not affected different size classes equally (see Table 3). Nationally the numbers of farms in the size classes of less than 500 acres have declined since 1940. Only 30

Table 2. Number of Farms, Number of Acres in Farms, and Percent Change During Preceeding Decade for the United States

Year	Number of Farms	Percent Change During Preceeding Decades	Number of Acres in Farms (in millions)	Percent Change During Preceeding Decade
1850	1,459,073		293,561	
1860	2,044,077	40.1	407,213	38.7
1870	2,659,985	30.1	407,735	0.1
1880	4,008,907	50.7	536,082	31.5
1890	4,564,641	31.9	623,219	16.2
1900	5,737,372	25.7	841,201	35.0
1910	6,361,502	10.9	878,798	4.5
1920	6,448,343	1.4	958,677	9.1
1930	6,228,648	-2.5	990,112[1]	3.3
1940	6,096,799	-2.1	1,065,114	7.6
1950	5,382,162	-11.7	1,161,420[1]	9.0
1959	3,710,503	-31.1	1,123,378[1]	-3.3
1969	2,730,250	-26.4	1,062,892[1]	-5.4
1978	2,478,642	-9.2	1,029,694[1]	-3.1

[1] Includes Alaska and Hawaii

Table 3. Number of Farms by Size of Farm in Acreage for the East North Central and West North Central Regions and for the United States, 1940-1978

Region and Year	< 50 Acres		50-99 Acres		100-259 Acres		260-499 Acres		500-999 Acres		1,000+ Acres		Total Number Of Farms
	N	%	N	%	N	%	N	%					
East North Central													
1940	269,776	26.8	268,033	26.6	401,913	39.9	58,601	5.8	6,895	0.7	877	0.1	1,006,095
1950	224,387	25.3	202,666	22.9	373,934	42.2	72,723	8.2	10,240	1.2	1,221	0.1	885,171
1959	133,424	20.0	136,723	20.5	291,067	43.7	88,319	13.3	15,016	2.3	1,638	0.2	66,187
1969	94,921	18.5	101,163	19.7	203,245	39.6	85,242	16.6	25,352	4.9	3,372	0.7	513,295
1978	109,956	24.3	80,536	17.8	146,880	32.5	73,977	16.3	33,480	7.4	7,641	1.7	452,470
West North Central													
1940	163,131	15.0	155,998	14.3	480,631	44.1	195,183	17.9	67,887	6.2	27,744	2.5	1,090,574
1950	137,599	14.0	120,084	12.2	423,252	43.1	191,346	19.5	75,698	7.7	34,432	3.5	982,411
1959	85,259	10.7	82,005	10.3	319,768	40.2	183,518	23.1	82,141	10.3	41,827	5.3	794,518
1969	67,223	10.5	62,339	9.8	213,650	33.5	155,944	24.4	87,575	13.7	51,858	8.1	638,589
1978	86,245	15.0	58,208	10.1	161,110	28.0	125,708	21.9	85,387	14.8	58,595	10.2	575,253
Total U.S.													
1940	2,286,607	37.5	1,291,042	21.2	1,796,075	29.5	458,786	7.5	163,675	2.7	100,531	1.6	6,096,716
1950	1,956,911	36.4	1,046,179	19.4	1,593,626	29.6	477,558	8.9	183,913	3.4	121,513	2.3	5,379,250
1959	1,051,935	28.4	657,683	17.7	1,186,612	32.0	471,394	12.7	197,383	5.3	135,895	3.7	3,703,922
1969	632,223	23.2	459,683	16.9	848,404	31.1	419,281	15.4	215,613	7.9	150,818	5.5	2,726,022
1978	685,337	27.7	386,804	15.6	669,308	27.0	354,295	14.3	215,058	8.7	161,999	6.5	2,472,801

percent of the number of farms of less than 100 acres that existed in 1940, was present in 1978. Farms of more than 500 acres increased substantially in numbers. Farms of more than 1,000 acres now account for 161 percent of farms that size in 1940. Overall, in 1978 there were approximately 40 percent of the number of farms that existed in 1940.

The shift in the number of farms from the smaller ones toward the larger ones becomes more impressive when it is taken into account that the number of large farms is a very conservative estimate of their presence. Table 4 indicates that, for the nation in 1978, although farms of less than 259 acres constitute 70 percent of all farms, they account for less than 15 percent of the land in farms. On the other hand, farms of more than 1,000 acres account for 6.5 percent of all farms, but for 58.5 percent of all farmland. The growth in number of larger farms thus in effect is a very significant phenomenon on the American rural scene.

REASONS FOR THE CHANGES

The changing structure of agriculture can be attributed to a large number of factors, none of which can be considered a significant cause in explaining the changes but all of which have contributed to the transformation that has occurred in agriculture. In the following section the main factors contributing to the changing structure of agriculture will be discussed.

Technology

Changing technology has been a necessary condition for the changing agricultural structure in the United States. Without the

Table 4. Number of Farms and Land in Farms by Farm Size for the United States, 1978

Farm Size (acres)	Land in Farms		Number of Farms	
	Acres	%	N	%
less than 50	13,820,681	1.3	690,329	27.8
50-99	28,069,446	2.7	387,022	15.6
100-259	110,416,095	10.7	669,596	27.0
260-499	126,984,338	12.3	354,427	14.3
500-999	147,882,938	14.4	215,112	8.7
more than 1,000	602,521,037	58.5	162,156	6.5
Total	1,029,694,535	100	2,478,642	100

Source: U.S. Bureau of the Census, Census of Agriculture: 1978, Vol. I, Summary and State Data, U.S. Government Printing Office, Washington, D.C., 1981, (Table 3, p.2).

technological underpinning the transformation in agriculture could not have taken place.

Two aspects of the technology are of relevance in the transition in agriculture: the decreased need for labor in agriculture, and the increased production per unit of land (Lu, 1979).

The replacement of human and animal labor (or the increased production per unit of labor) by mechanical power was the first great technological force operating in U.S. agriculture. It allowed existing acreage to be worked by many fewer hands than had formerly been the case. Inexpensive energy mass production of mechanical equipment, and the competition for labor with a rapidly industrializing urban sector facilitated the migration of labor out of agriculture, and allowed the remaining labor force to handle larger acreage than had before been possible. Without the competition from the urban labor market, especially during the period 1940-1970 (Binswanger, 1978), there might have been little incentive to reduce the agricultural labor force.

The second set of technological changes relates to increased production per unit of land: increased use of fertilizers, pesticides, crop management, and to some extent marketing technology. Future developments in bio-engineering, computerization of agriculture and other "high technology" developments all appear aimed at increases return per acreage.

In a general sense, these land saving technological developments may not affect the size distribution of farms; they are to some extent size neutral. However, there is ample evidence (Rogers, 1983) that access to new technology is unequally distributed throughout the farming community. Those farmers who control larger resources are most likely to influence the direction of technological developments, and to be in a position to take advantage of the new technology, thus placing them in a more favorable competitive position.

Market Factors

The impact of technology on the structure of agriculture takes place through the market factors. Over the time periods discussed in this paper, U.S. agriculture has greatly increased its output. For much of the time period, rapidly increasing output has been accompanied by quite inelastic demand. Consequently the returns from the increased agricultural production have been received to a significant degree by the consumer, to some extent by the technology provides (input suppliers), and only very partially by the agricultural producers. Returns to units of labor and land have been below a level necessary to maintain a standard of living comparable to that prevailing in the other sectors of the economy. To deal with the threat of low incomes, farmers have followed two courses of action. Many farmers have withdrawn their labor from agriculture, either completely by abandoning agriculture, or partially, by seeking employment off the farm and decreasing their hours worked on the farm (and possibly by reducing their leisure hours as well). These farmers have abandoned their dependence on the agricultural enterprise to provide a family income comparable to family incomes in the remainder of the economy.

Other farmers have attempted to enhance their family income not by increasing their return per unit, but by increasing the total size of the operation. If one cannot increase the dollar return per acre one can at least attempt to increase the number of acres from which a return is gathered.

For example, in the 1970s a 133 percent increase in real gross sales by an economic farming unit was necessary for farm family labor income to keep pace with national median family income (Tweeten, et al., 1980). For both alternative farmer behaviors, the labor saving technologies have provided the necessary means to carry out these family farm income strategies. In the case of larger farms it has been cheaper to divide the cost of mechanization over more acres thus providing additional incentive to enlarge the operation.

For part-time farmers, it is apparent that the reduced labor demands in agriculture have been essential to allow off-farm work. It is not clear, however, that the labor saving technology is also accompanied by reduced costs in part-time agriculture: most of the mechanical technology used in part-time farming appears derived from, and frequently is an outdated version of, the technology available to those farmers pursuing the enlargement strategy.

The existence of the two strategies is well illustrated in Table 5. In Table 5 farmers are classified according to the level of their farm sales (in 1973) and the magnitude of their farm income and their net total family income. Column 3 shows very clearly that for smaller farms the proportion of family income derived from the farm is quite small. For larger farms the importance of farm income to total family income increases quite consistently.

Other Factors Operating

The combination of technology and market forces has created two complimentary forces in U.S. agriculture; the drive towards larger farms (and thus fewer farm units) and the drive towards non-farm income or part-time farming.

Table 5. Families With Farm Income, By Specified Values of Farm Sales, and by Average Family Net Money Income, Average Net Farm Income as Percent of Average Family Net Money Income

Value of Farm Sales	Average Family Net Money Income (1)	Average Net Farm Income (2)	Farm Income as Percent of Family Income (3)
dollars	Dollars	Dollars	Dollars
under $50	8,650	-65	0
50-999	9,151	100	1.1
1,000-2,499	9,505	451	4.7
2,500-4,999	9,265	960	10.4
5,000-9,999	9,749	2,156	22.1
10,000-19,999	10,673	4,411	41.3
20,000-39,999	12,291	7,770	63.2
40,000-99,999	18,648	14,732	79.0
$100,000 or more	29,179	29,179	100

Source: Adapted from Crecink (1979:25).

Other forces have affected these developments. Governmental policies have - sometimes simultaneously - aided and impeded these developments. Inheritance and tax laws have sometimes forced farmers to sell, thus bringing land in the market that can be purchased to enlarge farms. Income maintenance programs in agriculture have usually had as their objective to provide adequate income for farm families from agriculture thus deferring both migration out of agriculture and the growth of part-time farming. Private sector policies appear to generally have favored the enlargement of farm operations through credit policies, quantity discounts, etc.

The most important role of the private sector may well be the area of providing nonagricultural employment. Whenever off-farm employment/income competes favorably with agricultural, farmers will be encouraged to find off-farm employment. If off-farm employment cannot be found in sufficient quantity in rural areas there will be a transfer of agricultural labor away from the farm thus further depleting the agricultural work force and stimulating the development towards larger - and fewer - farms. The development of part-time farming is very much dependent on the availability of employment near the farm. To the extent that non-farm employment is being created in rural areas, part-time farming is likely to grow.

While off-farm employment has provided many medium sized farm families with short-run opportunity to supplement their farm income, the combination of off-farm and farm income has proven less than optimal in most circumstances. The middle size farm places sufficiently high managerial, labor, and capital demands on the farm family to make it difficult to combine with off-farm work. For medium sized farmers, part-time farming may be a necessary state of affairs, but not necessarily one that endures over time, especially not over generations. Middle sized farms thus continue to decrease in numbers, as larger units continue to multiply and occupy more and more of the farmland. Small-scale farms will provide another growing class of farm operators at least in the near future, and in those areas where off-farm employment is available to provide those farm families with income.

COMMUNITY WELL-BEING AND FARM STRUCTURE IN THE CORNBELT

Agricultural Counties

The purpose of the present report is to understand in more detail how change in technology may affect the farm sector, and how those changes subsequently may affect agricultural communities in the Cornbelt region. For purposes of this report, the Cornbelt includes the states of Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa and Missouri.

The definition of agricultural communities is difficult to establish. Because of data availability the analysis focuses on counties rather than cities or towns. In addition the analysis is restricted to counties outside of Metropolitan Statistical Areas. In Metropolitan Statistical Areas, the economic value of the agricultural industry is overshadowed by the urban based economic activities; changes in agricultural income or employment are not likely to have measurable impact on the community.

Even in those counties which are not part of metropolitan areas, agriculture may be of minor significance while tourism, mining, and educational or even manufacturing activity may be of much greater significance. Therefore, the counties were further defined according to the importance of agriculture for the county economy. On the basis of the percent of labor and proprietor income accounted for by agriculture, the nonmetropolitan counties were grouped as follows: counties with at least 10 percent of labor and proprietary income coming from agriculture, the counties with at least 20 percent of income derived from agriculture and counties with at least 30 percent of labor proprietor income accounted for by agriculture

Table 6 provides the distribution of the nonmetropolitan counties according to the level of dependence on agriculture. The information is arranged by the states in the Cornbelt. As can be noted quickly, the counties depending on agriculture are located in the western part of the Cornbelt. For counties depending on 10 percent or more of agricultural income, almost 75 percent are located in Illinois, Minnesota, Iowa and Missouri. Considering only those counties that depend for 30 percent or more of their income on agriculture, we find all but 8 percent located in the four most western states of the Cornbelt.

Table 7 provides aggregate statistics on the Cornbelt region, as well as the non-metropolitan counties and the agricultural counties of the region. As shown in Table 7 the non-metropolitan counties account for about 30 percent of the Cornbelt's population and for over three-fourths of the Cornbelt farm population, farming acreage and sales.

When the proportion of county income derived from agriculture is taken into account, it becomes apparent that the agricultural counties account for a very modest percentage of the population: around 12 percent of the region's population lives in counties with at least 10 percent of county income derived from agriculture (see Table 7). Those counties most dependent on agriculture account for less than 2.5 percent of the region's population. Among the nonmetropolitan

Table 6. Distribution of Nonmetropolitan Counties, by Varying Levels of Dependence on Agriculture, for States in the Cornbelt

	Nonmetropolitan Counties		Dependence on Agriculture[a]					
			At Least 10 Percent		At Least 20 Percent		At Least 30 Percent	
	N	%	N	%	N	%	N	%
Ohio	49	8.67	14	4.19	1	0.52	-	
Indiana	62	10.97	30	8.98	15	7.81	5	5.00
Michigan	56	9.91	9	2.69	2	1.04	-	
Wisconsin	57	10.09	35	10.48	16	3.33	3	3.00
Illinois	80	14.16	50	14.97	30	15.63	17	17.00
Minnesota	71	12.57	58	17.37	35	18.23	26	26.00
Iowa	91	16.11	76	22.7	56	29.17	29	29.00
Missouri	99	17.52	62	18.56	37	19.27	20	20.00
Total	565	100	334	100	192	100	100	100

[a] Dependence on agriculture is measured in terms of the proportion of labor and proprietory income derived from agriculture. The figures are based on the years 1975-1979.

Table 7. Characteristics of the Cornbelt Region, Nonmetropolitan Counties in the Region, and the Nonmetropolitan Agricultural Counties

				Dependence of Agriculture[a]								
		Nonmetro Counties		10 Percent			20 Percent			30 Percent		
	Region	Value	Percent of Region	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro
Population 1980	53,101,523	15,446,750	29.09	6,561,206	12.35	42.48	3,000,400	5.65	19.42	1,277,287	2.41	8.27
Farm Population 1980	2,308,613	1,760,442	76.26	1,192,596	51.66	67.74	670,299	29.03	38.08	331,551	14.36	18.83
Total Farms (1978)	757,484	576,713	76.13	378,485	49.97	65.63	211,411	27.91	36.66	106,459	14.05	18.46
Acreage in Agriculture (in thousands) (1978)	182,579	146,967	80.49	103,445	56.66	70.39	63,236	34.63	43.03	33,984	18.61	23.12
Total Sales (in millions) (1978)	33,468	26,245	78.42	19,395	57.95	73.90	12,084	36.11	46.04	6,399	19.12	24.38
Number of Counties	732	565	77.19	334	45.63	59.12	191	26.09	33.81	100	13.66	17.70

[a] Dependence on agriculture is measured in terms of the proportion of labor and proprietory income derived from agriculture. The figures are based on the years 1975-1979.

population these proportions are, or course, higher but the most agriculturally dependent counties still account for well under 10 percent of the nonmetropolitan population.

Table 7 also indicates that the agricultural counties account for considerably more of the agricultural activities of the area than might be inferred from the small population share. Those counties with at least 10 percent of income derived from agriculture account for around half of farm population and the number of farms, and a little over half of the acreage in agriculture and value of agricultural sales in the region. However, the regional significance of the agricultural counties diminishes rapidly when only counties with 20 percent or 30 percent dependence on agriculture are taken into account.

The counties with the heavier dependence on agriculture are thus geographically concentrated in the western part of the Cornbelt, and they account for a minor percentage of the agriculture in the region. In the subsequent analysis the focus will be predominantly on the group of counties that draw at least 10 percent of their income from agriculture. Those counties are more representative of the region both in distribution and in terms of the proportion of the agricultural activity that takes place within their boundaries. However, information on those subsets of counties which are more dependent on agriculture (20 percent) or most dependent (30 percent) will be provided when feasible to allow for special observations under more extreme circumstances.

Types of Agricultural Counties

Change in technology will not impact agriculture uniformly. Technological change is most likely to be enterprise specific and changes in the grain industry are probably not reflected among dairy farmers. In order to be able to make separate evaluations, the counties in the study have been subdivided into "grain" counties, "dairy" counties, and the remainder called "mixed agricultural" counties, depending on the dominant type of agricultural enterprise.

The dairy counties account for a very minor part of the region's population, and agricultural activities. Large declines in the dairy industry will not have a noticeable impact in the region with the possible exception of the effects in Wisconsin where almost all dairy counties are located. The grain and mixed counties are more numerous and under the most inclusive definition they account each for about 5 percent of the region's population and one-fourth of the region's agricultural activities. Finally the mixed agricultural counties account for about 6 percent of the region's population and around 30 percent of the region's agricultural activities. The data indicate that major changes in the grain and mixed agricultural counties could have a noticeable impact in the region.

Grain Counties

Grain counties (Figure 2) realize more than 50 percent of their agricultural sales from the sale of grain. In the Cornbelt, grain sales include wheat, corn and soybeans, but some minor grains are also included in many counties. Grain counties are characterized by the relative preponderance of flat, lightly rolling terrain. Within the Cornbelt grain farming is predominantly carried out by family based enterprises, with a considerable input of outside capital, through the renting of land, but with the household providing much of the labor and management.

Figure 2. Distribution of Grain Counties in the Cornbelt According to the Degree of County Dependence on Agriculture

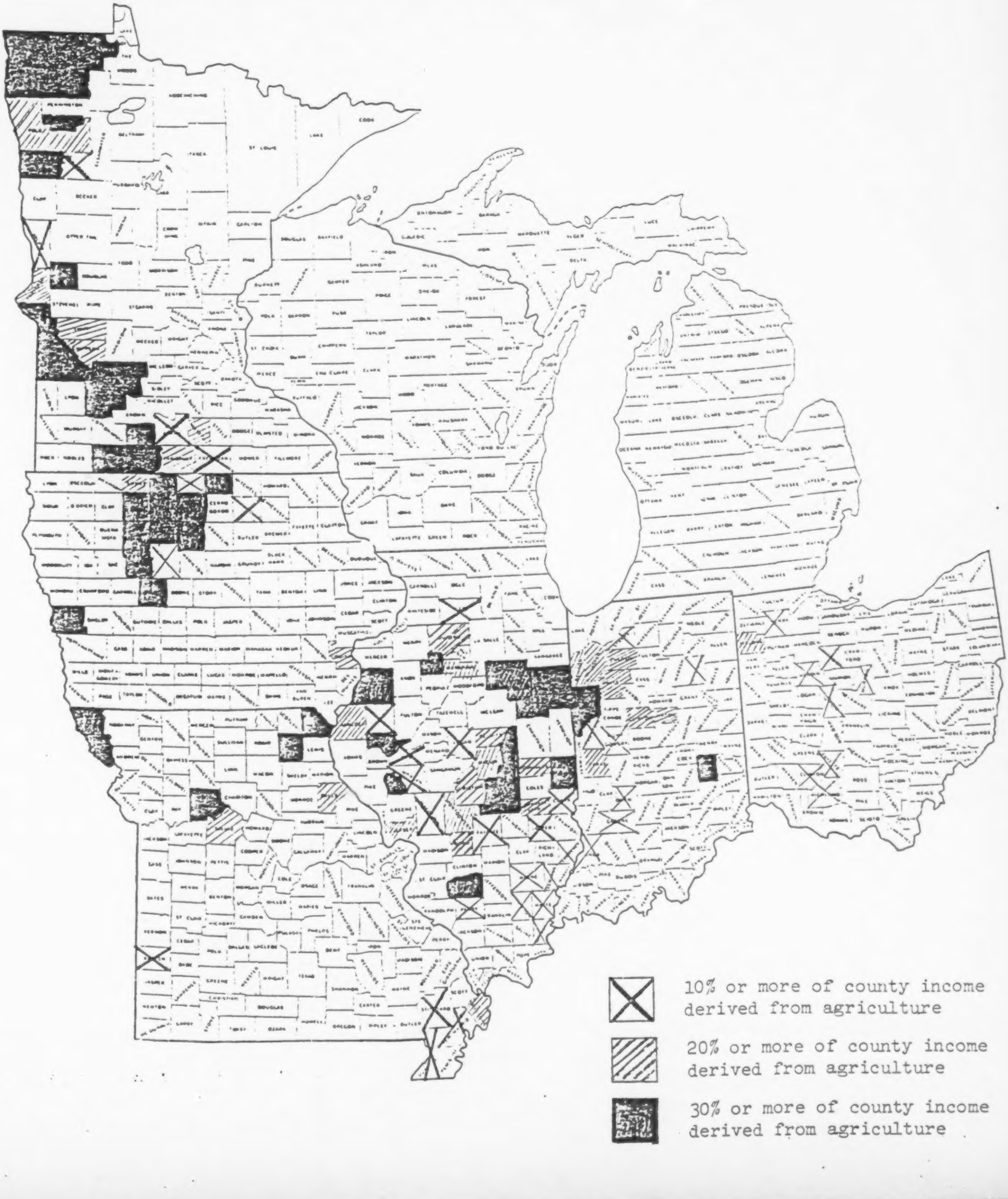

10% or more of county income derived from agriculture
20% or more of county income derived from agriculture
30% or more of county income derived from agriculture

Table 8 indicates that the agriculturally dependent grain counties account for about one-fifth of the agricultural acreage and sales and about 16 percent of farm population and number of farms of the dependence of agriculture is defined in terms of at least 10 percent of county income. The counties more dependent on agriculture account, of course, for less of the region's agriculture, with the most dependent counties (more than 30 percent) accounting for less than 10 percent of the region's agriculture.

Because the present paper is concerned with the impact of changes in the structure of agriculture on the community some data are presented in Table 9 which allows one to make some inferences about community level factors associated with scale differences in agriculture. At each level of agricultural dependence, the grain counties have been divided into two groups according to the percent of total agricultural sales that can be attributed to farms with sales of more than $100,000; the counties are classified according to the regional mean value of the concentration of sales on the farms in the largest sales class.

Table 9 indicates that in counties with a higher concentration of sales on the larger farms, it is more likely that farms are fully rented and that some labor will be hired. The farm operators are less likely to work at least 100 days off the farm. These factors are what would be expected in an agricultural setting characterized by larger farms.

Table 9 also indicates that the counties characterized by the greater prevalence of larger farms tend to have larger populations and are more urbanized. Median family incomes are higher and the occurrence of poverty is less frequent. In the counties with higher

Table 8. Characteristics of Grain[a] Counties in the Cornbelt Region According to the Percent of County Income Derived from Agriculture

	10 Percent			20 Percent			30 Percent		
	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro
Population 1980	2,373,079	4.47	15.36	1,236,578	2.33	8.01	631,437	1.19	4.09
Farm Population 1980	379,074	16.42	21.53	239,149	10.36	13.58	146,563	6.35	8.33
Total Farms (1978)	122,812	16.21	21.29	77,135	10.18	13.37	47,892	6.32	8.30
Acreage in Agriculture (in thousands) (1978)	39,602	21.69	26.95	26,600	14.57	18.10	16,900	9.26	11.50
Total Sales (in millions) (1978)	7,133	21.31	27.18	4,878	14.57	18.59	3,097	9.25	11.80
Number of Counties	122	16.67	21.59	76	10.38	13.45	45	6.15	7.96

[a] Grain counties are nonmetropolitan counties, with more than 50 percent of agricultural sales accounted for by the sale of grains.

Table 9. Comparison of Cornbelt Counties With Greater and Lesser Concentration of Sales on Farms With Sales of More Than $100,000 for Counties Dominated by Grain Production

Mean County Values (ca 1980)	10 Percent Counties With Sales Concentration		20 Percent Counties With Sales Concentration		30 Percent Counties With Sales Concentration	
	Below the Regional Mean	Above the Regional Mean	Below the Regional Mean	Above the Regional Mean	Below the Regional Mean	Above the Regional Mean
Agriculture						
Percent of Renters of Farms	15.35	25.57	17.84	26.44	18.70	27.23
Hired Labor 150+ Per Farm	.19	.32	.21	.30	.22	.26
Percent of Farms Hiring Some Labor	38.18	46.85	40.63	47.67	42.80	48.00
Percent of Operators Working 100+ Days Off Farm	32.57	26.14	27.53	24.47	24.26	22.59
Demographic						
Total Population	18,074	21,022	14,258	18,507	13,269	14,829
Percent of Farm Population	20.03	16.80	23.49	18.89	26.44	22.75
Percent of Urban Population	24.95	32.19	18.35	28.78	17.00	21.95
Median of Median Family Income ($)	16,706	18,665	16,637	18,623	15,844	18,221
Median of Percent Poverty	9.46	8.05	10.00	8.07	11.60	8.30
Business and Employment						
Retail Sales Per Capita ($)	2,521	2,711	2,370	2,627	2,519	2,446
Percent Employment: Manufacturing	20.93	22.04	18.15	21.80	14.78	19.36
Percent Employment: Services	18.72	18.38	19.10	17.53	18.95	18.00
Percent of Unemployed	7.94	6.96	7.43	6.64	7.43	6.14
Number of Counties	65	57	40	36	23	22

concentration employment in manufacturing is somewhat higher and unemployment somewhat lower. On a per capita basis, more is spent on retail sales in the counties with a greater concentration of the agricultural sales on the larger farms. Overall, it can be argued that for the grain counties, the greater concentration of sales on larger farms is associated with a higher level of economic well-being.

Table 9 provides an opportunity to look at the importance of concentration at different levels of county dependence on agriculture. Although there are some differences between the groups of counties, the data indicate that the patterns associated with the higher levels of concentration are the same regardless of the level of dependence on agriculture. Higher concentration is associated with higher per capita income, lower levels of poverty and less unemployment. The only reversal is found for retail sales per capital but in view of other information in this report, that difference can reasonably be attributed to chance.

Dairy Counties

The dairy counties (N=28) are those counties where dairy sales account for more than 50 percent of the agricultural sales. Figure 2 indicates that the dairy counties are predominantly located in Wisconsin on hilly terrain that leads itself less to grain production. The dairy industry is characterized by modest size enterprises and a very low level of full-renting. Table 10 indicates the small regional significance of the dairy counties.

When the dairy counties are classified according to the percent of total sales accounted for by farms with sales exceeding $100,000, it can again be noted that the counties with higher concentrations of farm

Figure 3. Distribution of Dairy Counties in the Cornbelt According to the Degree of County Dependence on Agriculture

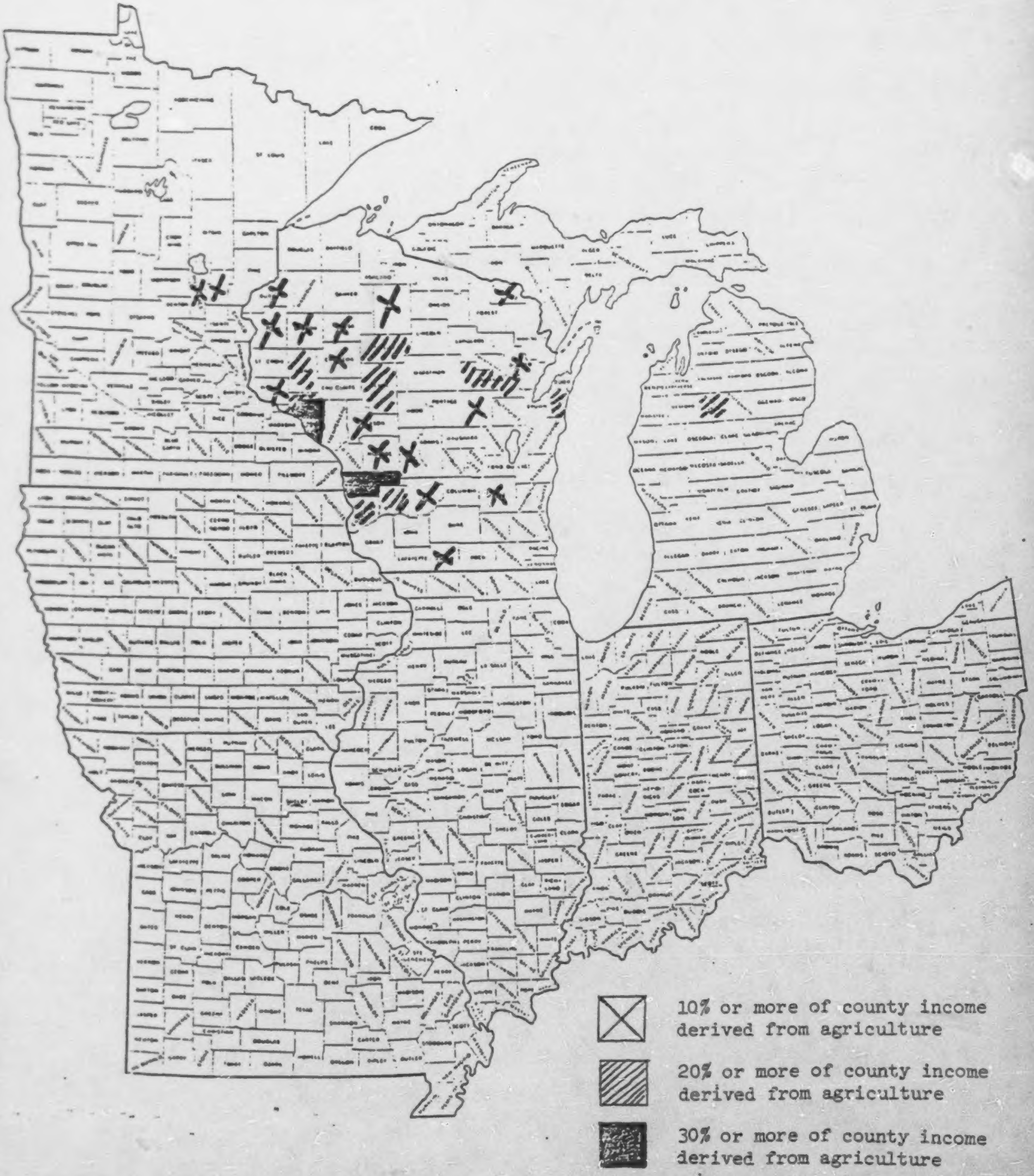

☒ 10% or more of county income derived from agriculture
▨ 20% or more of county income derived from agriculture
■ 30% or more of county income derived from agriculture

Table 10. Characteristics of Dairy[a] Counties in the Cornbelt Region According to the Percent of County Income Derivad from Agriculture

	County Income Derived from Agriculture								
	10 Percent or More			20 Percent or More			30 Percent or More		
	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro
Population 1980	759,081	1.43	4.91	232,977	0.44	1.51	39,951	0.08	0.26
Farm Population 1980	127,455	5.52	7.24	52,702	2.28	2.99	11,991	0.52	0.68
Total Farms (1978)	39,005	5.15	6.76	15,578	2.06	2.70	3,611	0.48	0.63
Acreage in Agriculture (in thousands) (1978)	8,273	4.53	5.63	3,336	1.83	2.27	784	0.43	0.53
Total Sales (in millions) (1978)	1,388	4.15	5.29	534	1.59	2.03	119	0.36	0.45
Number of Counties	45	6.15	7.96	11	1.50	1.95	2	0.27	0.35

[a] Dairy counties are nonmetropolitan counties, with more than 50 percent of agricultural sales accounted for by the sale of dairy.

sales on the larger farms are both larger and somewhat more prosperous. It is surprising to note that in the dairy counties, where the labor demands of the agricultural enterprise are high, there is a very large amount of off-farm employment (Table 11). Because of the small number of dairy counties, a comparison of the different levels of agricultural dependence among the dairy counties is not meaningful.

Mixed Agricultural Counties

Once the counties characterized by the grain and dairy industry have been separated, the remainder of the counties (N=181) can be characterized as "mixed" in terms of the dominant agricultural enterprises. The exact nature of these counties varies considerably. However, Figure 4 indicates that most of the counties are in the western part of the Cornbelt and they are characterized by mixed grain livestock farm enterprises. But in some cases the counties contain different enterprises such as grain, livestock or dairy without any of them accounting for more than 50 percent of the agricultural sales.

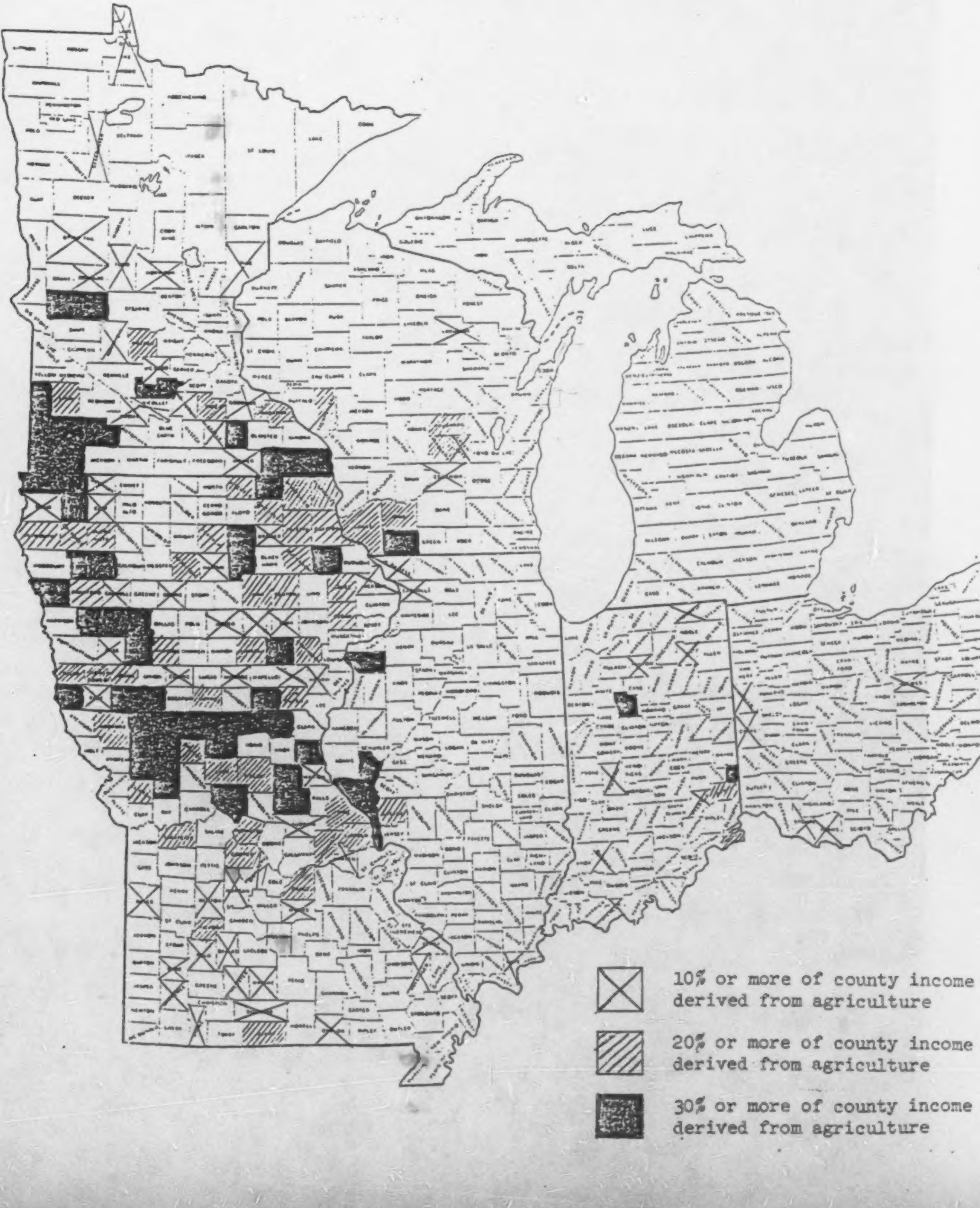
Counties characterized by mixed agriculture and at least 10 percent dependence on agriculture account for 6.5 percent of the region's population; but around 30 percent of the region's farm population acreage and agricultural sales. When looking at the 53 mixed agricultural counties most dependent on agriculture, it is clear that their regional signficance is much diminished; they account for about 1 percent of the region's population and less than 10 percent of the agricultural activities.

Mixed agricultural counties with heavier dependence on agriculture are somewhat different from counties with lesser dependence on agriculture (Table 13). Agriculturally, farms in the most dependent

Table 11. Comparison of Cornbelt Counties With Greater and Lesser Concentration of Sales on Farms With Sales of More Than $100,000 for Counties Dominated by Dairy Production

Mean County Values (ca 1980)	10 Percent Counties With Sales Concentration		20 Percent Counties With Sales Concentration		30 Percent Counties With Sales Concentration	
	Below the Regional Mean	Above the Regional Mean	Below the Regional Mean	Above the Regional Mean	Below the Regional Mean	Above the Regional Mean
Agriculture						
Percent of Renters of Farms	4.09	5.63	6.54	4.50	8.69	6.45
Hired Labor 150+ Per Farm	0.29	0.43	0.32	0.46	0.21	0.54
Percent of Farms Hiring Some Labor	43.53	47.27	45.15	48.17	55.56	48.91
Percent of Operators Working 100+ Days Off Farm	35.20	30.39	27.46	30.71	31.25	24.76
Demographic						
Total Population	20,576	31,950	20,280	21,929	25,642	14,309
Percent of Farm Population	18.93	16.34	26.19	19.45	31.55	27.33
Percent of Urban Population	19.07	27.27	15.60	22.83	14.00	18.00
Median of Median Family Income ($)	15,790	16,996	15,703	16,262	15,703	16,996
Median of Percent Poverty	10.60	8.6	11.00	9.17	10.6	8.6
Business and Employment						
Retail Sales Per Capita ($)	2,391	2,687	2,379	2,154	1,807	1,893
Percent Employment: Manufacturing	22.54	23.40	20.00	21.17	16.00	16.00
Percent Employment: Services	18.15	18.53	17.20	18.50	19.00	18.00
Percent of Unemployed	8.62	7.47	7.40	8.00	6.00	7.00
Number of Counties	13	15	5	6	1	1

Figure 4. Distribution of Mixed Agriculture Counties in the Cornbelt According to the Degree of County Dependence on Agriculture


10% or more of county income derived from agriculture
20% or more of county income derived from agriculture
30% or more of county income derived from agriculture

counties are slightly more likely to be fully rented and to hire some labor. In those counties, the farm operator is less likely to work more than hundred days off the farm. The counties tend to contain lower population, and higher percentage of farm population, lower median incomes and higher levels of poverty, while retail sales and manufacturing employment levels are lower. These types of differences are not expected and to some extent they can be observed among the grain and dairy counties. Counties heavily dependent on agriculture in general turn out to be somewhat less prosperous.

However, Table 13 indicates again, that for all levels of county dependence on agriculture, those counties with greater concentration of sales on larger farms show some characteristics expected to be associated with larger farms: higher frequency of renting, more hiring of labor, and less incidence of substantial off-farm employment by the farm operator. The mixed counties with the higher sales concentation are also found to contain on the average more people, to be more urbanized, and to be more prosperous, with lower levels of unemployment and a smaller percentage of the population below the poverty line.

Change in Agricultural Counties

To further investigate the relationship between the structure of agriculture and community well-being, the impacts of farm structure on changes in community characteristics that indicate overall community viability are investigated with regression analyses. The community characteristics that are the dependent variables in the analyses are: 1) percent population change, 1970-80; 2) percent change in median family income, 1970-80; and 3) change in poverty status 1970-80. The latter community characteristic is measured by substracting the percent

Table 12. Characteristics of Mixed[a] Counties in the Cornbelt Region According to the Percent of County Income Derived from Agriculture

	County Income Derived From Agriculture								
	10 Percent or More			20 Percent or More			30 Percent or More		
	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro	Value	Percent of Region	Percent of Nonmetro
Population 1980	3,429,046	6.46	22.20	1,530,845	2.88	9.91	605,899	1.14	3.92
Farm Population 1980	686,067	29.72	38.97	378,448	16.39	21.50	172,997	7.49	9.83
Total Farms (1978)	216,668	28.60	37.57	118,698	15.67	20.58	54,956	7.26	9.53
Acreage in Agriculture (in thousands) (1978)	55,570	30.44	37.81	33,300	18.24	22.66	16,300	8.93	11.09
Total Sales (in millions) (1978)	10,874	32.49	41.43	6,672	19.93	25.42	3,183	9.51	12.13
Number of Counties	181	24.73	32.04	104	14.21	18.41	53	7.24	9.38

[a]Mixed counties are nonmetropolitan counties, with neither dairy nor garin accounting for more than 50 percent of agricultural sales.

Table 13. Comparison of Cornbelt Counties With Greater and Lesser Concentration of Sales on Farms With Sales of More Than $100,000 for Counties Dominated by Mixed Agriculture

Mean County Values (ca 1980)	10 Percent Counties With Sales Concentration		20 Percent Counties With Sales Concentration		30 Percent Counties With Sales Concentration	
	Below the Regional Mean	Above the Regional Mean	Below the Regional Mean	Above the Regional Mean	Below the Regional Mean	Above the Regional Mean
Agriculture						
Percent of Renters of Farms	9.90	19.43	11.76	22.11	13.30	22.85
Hired Labor 150+ Per Farm	0.18	0.26	0.19	.26	0.17	0.25
Percent of Farms Hiring Some Labor	36.85	43.87	37.67	45.87	38.35	47.03
Percent of Operators Working 100+ Days Off Farm	36.34	27.65	32.54	22.76	29.15	21.85
Demographic						
Total Population	16,776	21,874	13,174	16,794	10,213	13,290
Percent of Farm Population	22.93	21.62	26.95	25.15	39.54	27.52
Percent of Urban Population	18.82	30.01	14.20	27.81	8.97	21.29
Median of Median Family Income ($)	15,363	18,184	15,363	17,768	14,729	17,070
Median of Percent Poverty	11.63	8.68	11.92	9.36	13.50	10.33
Business and Employment						
Retail Sales Per Capita ($)	2,300	2,699	2,162	2,616	2,197	2,398
Percent Employment: Manufacturing	20.16	19.72	17.18	16.95	13.97	15.81
Percent Employment: Services	17.95	18.40	17.87	18.63	18.21	18.10
Percent of Unemployed	7.18	5.53	6.23	4.98	6.03	4.76
Number of Counties	109	72	61	43	32	21

of families below the poverty level in 1980 from the percent in 1970. The measure of change in poverty status is limited by available data.

The determinants of change in the measures of community well-being are grouped into state variables and change variables. Inclusion of state variables is necessary to account for beginning of period nonagricultural conditions that, in addition to changes in agricultural characteristics, may impact change in population, incomes and poverty levels. The general model of change in the community characteristics estimated with county level data from selected Cornbelt counties is:

Change in Community Well-Being = f(State Var., Farm Structure Var.) [1]

To adjust for the nonfarm environment so the impact of changes in the structure of the farm sector could be isolated, the 1970 median family income, percent manufacturing employment and percent service employment are included as state variables. Communities with relatively higher incomes, and more diversified employment structures, as evidenced by the proportion of manufacturing and service employment, are expected to experience different population, income and poverty status changes than areas with lower incomes and less diverse economies.

In addition to the nonfarm state factors, the percent of farmland classified as cropland in 1970 was used to adjust for variation in the quality of the agricultural resource base in the community. As suggested by Kessler and Grennberg (1981), 1970 observations on the dependent variable were also included as state variables. The measures of change in the structure of agriculture used to analyze the relationship between changes in farming and community well-being are the percent change in the operators working 100 or more days off-farm, the percent change in the number of full and part farm owners and the percent of total sales of agricultural products accounted for by farms selling over $100,000 annually. In addition, the percent change in farm population is also included. Data availability limited the sales measure to the percent reported in 1978.

Structural changes in the farming sector can be expected to impact the population in an area both directly and indirectly. The direct impact is through farm numbers. A shift to a more concentrated, large-size farm structure is expected to negatively impact population growth as the decline in farm families reduces the number of people in the community. One study reported that a large farm structure would require almost 40 percent less direct on-farm labor than a small farm organized agriculture (Sonka and Heady 1974). The indirect impact on population is through those sectors which supply inputs and personal services to production agriculture. With a shift from small to larger farms, fewer inputs would be required, ceteris paribus, resulting in lower levels of off-farm activities. A structure of large farms has been estimated to generate about 25 percent less off-farm economic activity compared to a structure of small farms (Sonka and Heady 1974).

The indirect effects of reductions in economic activity from a shift to a large farm structure would expectedly have the most severe implications for community change in rural areas most dependent on farm production for basic economic activities. Employment multipliers for larger (above 20,000 in total population) rural counties have been estimated at 3.06 while comparable multipliers for smaller rural counties were reported at 2.40 (Braschler and Kuehn 1976; also see Marousek 1979 and Fass et al. 1981).

There is strong evidence that, although a reduction in farm numbers would negatively impact rural community employment, continuing farmers would experience substantial improvements in net per farm operating income. Research has reported large farm structure per farm returns at over 300 percent greater than a farm system dominated by small farms. The major problem associated with a small farm agriculture is farm returns at poverty income levels (Sonka and Heady 1974). This accounts for the heavier reliance by Cornbelt farmers on off-farm income in communities with a smaller-scale farm sector.

While evidence suggests a concentrated farm structure will negatively impact population change, income indicators of community well-being may be positively related to the degree of concentration in agriculture; at least per farm returns are expected to be higher. This relationship would be expected to be stronger in smaller population counties and counties more dependent on farming for basic economic activities. However, countering the positive income effects of farm concentration from the farm level are off-setting negative income effects at the community level. Income generated in an area because of farm production is comprised of: 1) the income received by the producers; 2) the income associated with the activity of agri-business firms, both input suppliers and output handlers and processors; and 3) the income resulting from sales of consumer goods to farmers and individuals involved in agri-business. While the income of producers is lower under a small farm structure, the level of input usage and off-farm economic activity is higher. Expectations on the outcome of these conditions for median family community income is for incomes to be higher in areas with a smaller scaled farming sector.

There is some empirical evidence supporting a negative relation between farm concentration and community income for the Midwest, however, the descriptive data presented previously suggests the opposite. Heady and Sonka (1975) reported an "income generation" value 17 percent higher in the major Cornbelt states and 21 percent higher in the three Great Lake states for a small farm organized agriculture compared to the typical mixed farm structure. The values were about 30 percent higher when a small farm structure was compared to a large farm structure. The "income generation" value is the amount total income will change because of a one dollar change in the value of farm production. Part of the impact of changes in farm structure on community income reported by Heady and Sonka (1975) were the result of relatively higher farm output prices simulated under their small farm agriculture alternative. For example, feed grain prices were 35 percent higher under the small farm alternative compared to the large farm alternative. This accounts for part of the higher incomes reported for the small farm alternative. In a cross-sectional analysis all output prices are approximately the same. Any observed relationship between farm structure and community income will reflect only the impacts of greater off-farm agricultural related economic activity and subsequent rounds of consumption spending.

Ownership of the land resource is a dimension of the structure of farming that is often argued to impact the surrounding community in ways not captured directly in employment or income indicators. At issue is whether farming communities characterized by owner-operated farms are substantially different and possibly better-off than similar areas dominated by tenant operated farms. One difference ownership variation would cause would be a larger acreage requirement for full tenants compared to full owners to generate a comparable level of family income. It is estimated that for Illinois grain farms, 300 acres of debt free land will provide an acceptable income for a farm family. A tenant farm family would need to operate 700-800 acres to earn a comparable income. This suggests that increased tenant farming or reduced owner operator farms may be associated with lower population growth, other things being equal. Fewer, large tenant farms may also be neutral with regard to income changes. This stands in contrast to the notion that per farm income increases with larger farms. The impact of land ownership change on income change is an empirical question with no relationship hypothesized, a priori.

The results of estimating the model using ordinary least squares regression to analyze the determinants of change in population, median family income and poverty level are presented in Tables 14 though 21. The model was estimated using observations from grain counties, dairy counties and the mixed agricultural counties for counties with 10 percent income from farming and grain counties and mixed farming counties for Cornbelt counties with 20 percent and 30 percent of county income coming from agriculture. To few dairy counties were in the latter groups for realistic estimations.

As expected, manufacturing employment in 1970 (MFGEMP70) and service employment in 1970 (SEREMP70) were generally positively related to population change as evidenced in Table 14. The population in 1970 (POP70) was not significantly related to population growth in any of the estimates. Percent farmland in crops (CRPLND70) is negatively related to population change in the grain and mixed farming counties but positively related to population change in the dairy counties. The former relationship may reflect the more attractive amenity factors

Table 14. Determinants of County Population Change For Counties 10 Percent Dependent on Agriculture[a]

	Type of County					
	Grain		Dairy		Mixed	
Variable	Coefficient	Beta	Coefficient	Beta	Coefficient	Beta
MFGEMP70	.4234* (4.86)	.4741	-.1838 (0.77)	-.1552	.3126* (3.28)	.2618
SEREMP70	.8648 (1.29)	.1067	4.0258* (2.58)	.4129	1.7532* (3.45)	.1988
CRPLND70	-.3679* (3.59)	-.3246	.2984** (1.90)	.4127	-.2764* (3.72)	-.3354
POP70	-.9601 (1.46)	-.1179	-.000004 (0.04)	-.0067	-.00004 (0.46)	.0342
INCOM70	.0009 (1.30)	.1353	-.0005 (0.25)	-.0564	.0013 (1.52)	.1486
CHNGOWN	-.1102 (1.10)	.1222	-.8608** (2.93)	.7105	-.3616* (3.17)	-.3061
CHNG100+	.0465 (0.91)	.0801	.1594** (1.92)	.3040	.1430* (2.52)	.2067
CHNGFRMPOP	-.0364 (0.73)	.0547	.0017 (0.12)	.0021	.1597* (2.46)	.1447
LRGFRMSLS	-.0479 (0.65)	-.0578	.0780 (0.43)	.0862	-.0512 (0.72)	-.0636
Constant	14.34*		-38.71*		-1.23	
Sum of Squares	4329		537		12174	
F-Ratio	11.62		4.75		16.42	
R (Adjusted)	.44		.56		.44	
n	122		28		181	

[a] Dependent variable is percent population change 1970-80. Absolute t statistics are in parentheses.

* Significant at .05 level.
** Significant at .10 level.

associated with a diverse landscape not dominated by cropland as a living environment.

The negative significant coefficient on the percent change in the number of operators that are full or part owners (CHNGOWN) gives some support to the expectation that increased tenant farming places a drag on population growth because of the larger farms (thus fewer farm people) required to earn the same family income when land is rented compared to full owner, land debt free farms. This relationship is statistically significant in the dairy and mixed farming counties. The change in the number of farmers working 100 or more days off-farm (CHNG100+) is positively related to population change. The coefficient on this variable is not statistically different from zero in the grain counties' model. The coefficient on the percent of total farm sales accounted for by farms with over $100,000 in sales (LRGFRMSLS), is mixed in sign across the estimates in Table 14, but is not statistically different from zero in any case. The weakness of this result may be the result of measurement problems associated with the sales indicator of farm structure. Interestingly, farm population change (CHNGFRMPOP) is only significantly related to overall population change for the sample of mixed farming counties.

The determinants of county population change for Cornbelt counties with at least 20 percent and 30 percent of their income coming from agriculture in Table 15 generally reinforce the findings of the model estimated with counties having 10 percent of more farm income.

Generally, the estimates do not provide strong support for a relationship between the measures of farm structure and county population change for the 1970s. A shortcoming of analyses at this general level are measurement and data problems. This could account

Table 15. Determinants of County Population Change For Counties 20 and 30 Percent Dependent on Agriculture[a]

	-- 20 Percent --		-- 30 Percent --	
Variable	Grain	Mixed	Grain	Mixed
MFGEMP70	.3119* (2.57)	.3054* (2.49)	.3484* (2.78)	.3283* (2.47)
SEREMP70	.9597 (1.08)	1.8551* (2.98)	.5312 (0.57)	.5212 (0.76)
CRPLND70	-.3124* (2.17)	-.2511* (2.98)	-.2359** (1.71)	-.0343 (0.34)
POP70	-.0001 (0.68)	.0001 (0.04)	.00002 (0.19)	-.0002 (0.80)
INCOM70	.0024* (2.24)	.0018** (1.69)	-.0001 (0.06)	.0016 (1.54)
CHNGOWN	-.2507** (1.73)	-.3142* (2.24)	.0549 (0.30)	-.1600 (1.12)
CHNG100+	.0637 (1.05)	.0924 (1.53)	.0073 (0.14)	.0394 (0.72)
CHNGFRMPOP	-.0512 (0.78)	.0822 (0.89)	.0329 (0.41)	.2260* (2.15)
LRGFRMSLS	-.0121 (0.11)	.0223 (0.24)	-.0190 (0.17)	-.0557 (0.69)
Constant	-5.42	-12.82	19.70	-9.94
Sum of Squares	2,689	4,504	679	953
F-Ratio	5.72	8.82	2.83	3.70
R (Adjusted)	.36	.41	.27	.31
n	76	104	45	53

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[a] Dependent variable is percent population change 1970-80. Absolute value of t statistics are in parentheses.

* Significant at .05 level.
** Significant at .10 level.

for the general absence of more robust results. The small number of dairy counties is also problematic for that model.

The farm structure variables related to change in median family income are the percent change in the number of farmers working 100 or more days off-farm (CHNG100+) and the percent of total farm sales accounted for by farms with over $100,000 in sales (LRGFRMSLS). The estimates of these models are presented in Table 16. The coefficient on CHNG100+ is positive and signficant in the dairy county and mixed farming county models. The coefficients on LRGFRMSLS is positive and signficant in the grain county and mixed county estimate. These results support the earlier descriptive evidence suggesting more concentrated agriculture is reflected in a greater improvement in median family income. The positive relationship between farm concentration and growth in median fmaily income between 1970 and 1980 held for estimates using counties with 20 percent and 30 percent of their income from farming, which are given in Table 17.

Attempts to explain change in poverty status (Tables 18 and 19) met with limited success. Except for the mixed farming county estimates, the measurers farm structure were generally not statistically related to the change in the percent of families under the poverty level. For the three mixed farming county estimates, the coefficient on percent of farm sales accounted for by farms with over $100,000 in sales (LRGFRMSLS) was negative and statistically significant. This indicates in those counties, not dominated by grain or dairy enterprises, the more concentrated the farm sector the less change in the percent of families in poverty. An unambiguous evaluation of this result is difficult, but these findings indicate that if a low percent of families were below the poverty level in 1970,

Table 16. Determinants of Change in Family Income For Counties 10 Percent Dependent on Agriculture[a]

	Type of County					
	Grain		Dairy		Mixed	
Variable	Coefficient	Beta	Coefficient	Beta	Coefficient	Beta
MFGEMP70	.0209 (0.13)	.0139	.3509 (0.89)	.2125	.3362* (2.10)	.1759
SEREMP70	-3.7675* (3.41)	-.2759	4.1608 (1.34)	.3060	.0026 (.003)	.0002
CRPLND70	.3429** (1.87)	.1797	.3678* (1.26)	.3646	.3595* (2.81)	.2724
INCOM70	-.0098* (8.23)	-.8220	-.0080* (2.40)	-.6291	-.0120* (9.05)	-.8584
CHNGOWN	.2587 (1.52)	.1705	.4559 (0.78)	.2898	-.1110 (0.56)	-.0586
CHNG100+	-.0196 (0.22)	-.0200	.3751* (2.44)	.5130	.3148* (3.29)	.2842
CHNGPOP	.4494* (2.80)	.2669	-.4532 (1.13)	-.3249	.0925 (0.73)	.05774
CHNGFRMPOP	.1264 (1.50)	.1127	-.3058 (1.25)	-.2814	-.1404 (1.28)	-.0794
LRGFRMSLS	.3645* (2.88)	.2610	-.1360 (0.45)	-.1078	.3199* (2.72)	.2480
Constant	182.84		140.53		160.10	
Sum of Squares	12;716		1551		33,613	
F-Ratio	10.79*		2.55*		13.90*	
R (Adjusted)	.42		.34		.39	
n	122		28		181	

[a] Dependent variable is percent change in median family income, 1970-80. Absolute value of t statistics are in parentheses.

* Significant at .05 level.
** Significant at .10 level.

Table 17. Determinants of Change in Family Income For Counties 20 and 30 Percent Dependent on Agriculture[a]

	-- 20 Percent --		-- 30 Percent --	
Variable	Grain	Mixed	Grain	Mixed
MFGEMP70	.1700	.5545*	.2530	1.035*
	(0.88)	(2.27)	(0.80)	(2.77)
SEREMP70	-2.7443*	.7209	-3.1600	.7969
	(2.05)	(0.57)	(1.48)	(0.43)
CRPLND70	.3371	.3177*	.8255*	-.0173
	(1.52)	(1.85)	(2.09)	(0.66)
INCOM70	-.0112*	-.0137*	-.0151*	-.0207*
	(6.69)	(6.83)	(4.56)	(7.36)
CHNGOWN	.1457	.1290	.3343	.7764**
	(0.65)	(0.47)	(0.80)	(1.91)
CHNG100+	-.0202	.2037**	-.1069	.1430
	(0.22)	(1.74)	(0.88)	(0.97)
CHNGPOP	.5634*	.2087	.8255*	1.2112*
	(3.01)	(1.04)	(2.09)	(3.01)
CHNGFRMPOP	.0446	.0120	-.1291	-.4544
	(0.45)	(0.07)	(0.69)	(1.55)
LRGFRMSLS	.3180**	.4514*	.4389**	.5954*
	(1.90)	(2.53)	(1.71)	(2.81)
Constant	183.94*	169.25*	181.79*	232.06*
Sum of Squares	6,241	17,021	3,717	6,720
F-Ratio	6.51*	6.03*	5.11*	7.50*
R^2 (Adjusted)	.40	.31	.46	.53
n	76	104	45	53

[a] Dependent variable is percent change in median family income 1970-80. Absolute value of t statistics are in parentheses.

* Significant at .05 level.
** Significant at .10 level.

Table 18. Determinants of Change in Poverty Status For Counties 10 Percent Dependent on Agriculture[a]

	Type of County					
	Grain		Dairy		Mixed	
Variable	Coefficient	Beta	Coefficient	Beta	Coefficient	Beta
MFGEMP70	-.3477** (1.69)	-.1112	-.0696 (0.28)	-.1926	-.0550* (2.64)	-.1549
SEREMP70	.1311 (0.83)	.0462	.1089 (0.28)	.0366	-.0386 (0.31)	-.0147
CRPLND70	-.0375 (1.46)	-.0944	-.0189 (0.49)	-.0833	-.0024 (0.13)	-.0099
PURTY70	-.4607* (15.66)	-.9249	-.6981* (7.65)	1.0595	-.5310* (12.51)	-.8977
CHNGOWN	-.0055 (0.24)	-.0175	-.0485 (0.68)	-.1311	.0387 (1.40)	.1101
CHNG100+	-.0193 (1.58)	-.0948	-.0111 (0.58)	-.0695	-.0265* (1.29)	-.1287
CHNGFRMPOP	-.0273* (2.32)	-.1173	.0140 (0.47)	.0588	.0343* (2.17)	.1045
CHNGPOP	-.0319 (1.43)	-.0910	.0196 (0.39)	.0641	-.0231 (1.28)	-.0777
LRGFRMSLS	.0023 (0.13)	.0078	.0024 (0.06)	.0087	-.0538* (3.17)	-.2247
Constant	4.83		6.11		10.02	
Sum of Squares	247		24		693	
F-Ratio	39.25		12.33		36.03	
R (Adjusted)	.74		.79		.64	
n	122		28		181	

[a] Dependent variable is difference in percent of families below poverty level, 1970-80. Absolute value of t statistics are in parentheses.

* Significant at .05 level.
** Significant at .10 level.

Table 19. Determinants of Change in Poverty Status For Counties 20 and 30 Percent Dependent on Agriculture[a]

	-- 20 Percent --		-- 30 Percent --	
Variable	Grain	Mixed	Grain	Mixed
MFGEMP70	-.0539*	-.1021*	-.0208	-.1995*
	(2.02)	(2.90)	(o.49)	(3.24)
SEREMP70	.0344	.1427	.0683	.0266
	(0.16)	(0.77)	(0.21)	(0.09)
CRPLND70	-.0148	.0136	-.0367	.0513
	(0.44)	(0.53)	(0.73)	(1.13)
PVRTY70	-.4727*	-.6163*	-.5061*	-.7937*
	(10.22)	(9.02)	(4.42)	(7.67)
CHNGOWN	.0036	.0456	-.0565	-.0224
	(0.11)	(1.16)	(1.02)	(0.39)
CHNG100+	-.0153	-.0234	.0068	-.0290
	(1.07)	(1.37)	(0.39)	(1.20)
CHNGFRMPOP	-.0121*	.0289	-.0060	-.0364
	(0.78)	(1.10)	(0.21)	(0.75)
CHNGPOP	-.0258	-.0091	-.0629	.0164
	(0.90)	(0.13)	(1.06)	(0.25)
LRGFRMSLS	-.020	-.0923*	-.0204	-.1106*
	(0.76)	(3.56)	(0.51)	(3.19)
Constant	5.81**	11.66*	6.82	13.01*
Sum of Squares	151	362	83	183
F-Ratio	18.37	17.29	4.37	11.07
R^2 (Adjusted)	.68	.59	.41	.65
n	76	104	45	53

[a] Dependent variable is difference in percent of families below poverty level, 1970-80. Absolute value of t statistics are in parentheses.

* Significant at .05 level.
** Significant at .10 level.

a low percent would be found in 1980. The opposite would also hold. If a large percent of families were in poverty in 1970, a large percent would be expected in this income class in 1980 for mixed farming counties that have a concentrated farming sector.

The difficulties inherent in accurately measuring farm structure and community well-being change likely contributed to generally weak empirical findings. The shortcomings of the general analysis in confirming expected relations between changes in farm structure and community characteristics do not necessarily suggest these relations do not exist, but the preliminary analysis does not demonstrate strong linkages between agriculture and the economic structure of the rural communities serving and served by production agriculture in the Cornbelt. The most robust results were the determinants of income change. Here a more concentrated farming sector was positively related to median family income growth in the 1970s. The small number of dairy counties severly limited the general analysis of Midwest dairy communities.

Summary of Findings

Cornbelt agriculture has been characterized by the same changes that have characterized agriculture nationwide: declining numbers of farms with concomitant increases in farm size. Technological change has played an important role in bringing about this transformation. While the process of change continues in the Cornbelt, the major changes appear to have taken place two or three decades ago.

The impact of farm structure changes at the community level are difficult to isolate from other societal changes that may take place simultaneous. For example, agricultural counties (those receiving at least 10 percent of their income from farming) in the nonmetropolitan Cornbelt experienced differential population change and a sharp increase in unemployment during the 1970s, neither one of which can be attributed to structural changes within agricultural.

Comparisons within homogeneous groups (grain, dairy and mixed farming) of agricultural counties show that those counties with relatively stronger presence of larger farms tend to be somewhat better off than those counties where the process of concentration in agriculture has not progressed as far. The data used here do not provide evidence of negative county level consequences associated with the historical direction of change in farm structure in the Cornbelt. However, these same counties also contain, on the average, more people and are more urbanized with more manufacturing and service employment. Since it is difficult to isolate the implications of the urbanizing forces from the farm size forces for overall community well-being, these results should be interpreted with caution.

Attempts to develop an analytic understanding of the process of change in the agricultural communities during the 1970s met largely with frustration. The variables used in the analysis were selected on the basis of their expected impact on community population change and quality of life measurements. Apparently, the changes taking place in the agricultural Cornbelt counties are not related to any large extent to changes in farm size. As indicated, much of the change in farm size and its impact on local communities had already taken place before the time period covered by the analysis. While in the micro-environment changes in agricultural structure may still be significant (a rural bank may be taken over by outsiders, an elevator may fold) the aggregate impact in the Cornbelt, even in the agricultural counties, is quite small.

A caution should be raised about the period over which data were analyzed to suggest implications of changing farm size for rural community well-being in the Cornbelt. The 1970s was relatively prosperous for both the farm and non-farm sectors in the Midwest. Commodity prices were generally high, land values increased and non-farm economic growth characterized many regions. The general tone of economic vitality may mask some of the downside implications for rural communities associated with size changes in the farm sector. While this shortcoming should be recognized, the general findings are probably not undually biased.

FARM STRUCTURE AND RURAL COMMUNITIES: SCENARIOS FOR 2000

Causes of farm structure change include institutional forces such as federal farm policy, tax incentives and public investments in research and extension. Broad economic factors also cause change in the structure of agriculture. These factors include movements in the general price level, monetary policy and the behavior of international financial markets. These broader economic forces compound the structure shifts driven by factors internal to the farm sector with their impact being on the rate of change and not on the direction or eventual magnitude of changes. For example, recessionary conditions in farming that narrow margins and reduce farm incomes likely complement the other forces of change that have already substantially restructured Cornbelt farming. Boom times in farming, however, will have a positive impact on both ends of the scale. Incentives will be strong for farm size expansion. A robust farm economy will also cause farm income from smaller scale operations to be more competitive with income from other alternative occupations.

In addition to these forces acting on how agricultural resources are organized into production entities, technological change and economies of scale and size have changed the structure of farming in the Cornbelt and the entire country. The rewards for early adoption of new technologies place a premium on innovative, aggressive management behavior as technologies drive down average costs and encourage farm expansion. Labor and land substituting technologies have contributed to the continued growth in size of commerical corn and soybean grain farms in the Cornbelt during the past 30 years. Expansions of the past resulted in the development of monoculture, cash grain farming in many regions of the Midwest at the expense of animal agriculture (Westgren, et al., 1983: 32-45). However, these expansions have been toward more large family farms operating 1,000-2,000 acres and not toward few large super farms relying on hired management and labor with extensive outside capital.

Changes in farm structure induced by advancing production technologies have impacted rural Cornbelt communities in different ways. The sketchy evidence from the 1970s suggests the more farm dependent areas may in fact be better off when farm sales are concentrated in larger farms. Implications of future technological advances for rural communities associated with changes in farm structure are suggestive, at best. However, the composition of the farming economy across the Cornbelt is not homogeneous. Therefore, the impact of adopting new technologies will vary with the agricultural character of the area, and importantly, with the dependence on farming as a basic economic activity.

Technology and Cornbelt Farms

Agricultural technology can be divided into three categories: 1) biological, 2) mechanical, and 3) informational/management. Major advancements in mechanical technologies, fueled by cheap energy prices, released farm labor for use in other sectors since World War II. Labor substituting technologies have been a major force in the evaluation of large family farms that dominate Cornbelt agriculture. Biological and chemical technologies substantially increased per acre production. Both categories of technologies have shaped the structure of today's Cornbelt farming. Information technologies, which improve management, have generally not been significant in the past as forces impacting the structure of Cornbelt agriculture.

Biotechnology. Future agricultural technologies that will shape tomorrow's farming in the Cornbelt states will come from biotechnological advances, first, and information technologies, second. While not as spectacular, the evaluation and adoption of labor substituting technologies is expected to also continue to shape the structure of Cornbelt farms.

Because monoculture cash grain farming characterizes much of Cornbelt agriculture, the biotechnologies for animal agriculture will be of less significance, generally. Since the biotechnologies for plant agriculture are expected to bring changes relatively more slowly to this subsector, past trends in the Cornbelt will characterize much of the farm size change and related community effects for the rest of this century (OTA 1985).

An exception to this characterization will be parts of the Great Lake states, especially Wisconsin, where dairy production is a significant economic activity. Biotechnologies for dairy production are expected to significantly impact the industry in a short period of time and be in commercial use in the near future. The increased production per cow from these advances will accelerate the trends of the past further concentrating dairy production in very large herds. As indicated, only 28 Cornbelt counties were dairy counties and most of these are in Wisconsin. Thus, changes in the rate of dairy farm growth and consolidation associated with these types of technologies will potentially impact a limited number of Cornbelt areas. Technological advances in milk storage, and transport combined with the continued drop in fluid milk consumption are likely to overshadow structural changes in Cornbelt dairy farming directly linked to the biotechnologies applied to the "old milk cow". Changes in taste and preferences and storage and transport technologies suggest a decline in the relatively comparative advantage of the Cornbelt for milk production compared to the warmer climates in southern and western regions. A continued absolute decline in the dairy farms in the Cornbelt with cow level technology accelerating the consolidation of operations is likely to characterize trends in dairy production through the end of the century.

The combined impact of biotechnologies on the crop and animal farming in the mixed counties in the Cornbelt is more difficult to discern. This is particularly the case where pork production is important as is the case in much of Iowa, and parts of Illinois and Missouri. However, the rate of productivity increase in pork production under the most optimistic environment of technological advance is not significantly off past trends. This suggests structural changes linked to new biotechnologies may not be dramatically different from the events of the 1970s. What may well occur is just more of the type of restructuring that the hog industry has experienced to date. The impact of new technologies may be to accelerate the changes taking place.

Information Technology. It is more difficult to assess the impact of information technologies on corn and soybean dominated Midwest agriculture. Management information from electronic animal monitoring and other advances will be less significant because of the dominance of cash grain farming. Software advances in crop oriented management systems such as pest control modeling will be more important in the Cornbelt. Accounting, production and financial management and marketing computer assisted information systems will be as important for the financial success of the large family grain farm in the Cornbelt during the next 15 years as any other information technologies. Included in these technologies will be improved weather forecasting for optimal crop production. While these advances will provide early adoptors a comparative management advantage, they will not likely overshadow other more powerful forces shaping the organizational arrangement of agricultural resources in farms. The management technologies embedded in electronic information systems will be complementary to the biotechnologies of crop and animal agriculture. Effective application of these advances will require enhanced management skills demanding improved information. The information technologies will reinforce the structural impacts of biotechnologies.

Future Farm Size Distributions

The structure of farms in the United States were simulated under three different policy scenarios given the expected advances in production and management technologies. The policy scenarios represented: 1) a projection of current policies; 2) policies to speed the move to the bi-modal size distribution of farms; and 3) policies to retard the trend to larger sized farms. The scenarios were reported for all farms and major farm types (i.e. grain, dairy, cattle, poultry, hog and cotton). The grain and dairy farm distributions for the U.S. are presented in Table 20.

To investigate the implications of these scenarios for agriculture in the Cornbelt and for rural communities in the region, the farm size distribution under the first policy scenario (current policies projected to 2000 under expected technological change) is compared to available information on the current size distribution of Cornbelt farms. The comparisons are presented for the grain counties, the dairy counties and the mixed agricultural counties in the Cornbelt that are 10 percent dependent on farm income in Table 21. In general, the distribution of farms in the U.S. under scenario one is more concentrated compared to Cornbelt grain and dairy farms in 1978. This is not unexpected and relates to: 1) the impact of technological change and other factors during the rest of the century; and 2) differences in grain enterprises on Cornbelt grain farms compared to the nation. Midwest grain production is concentrated in corn and soybeans which is generally smaller in scale than wheat and other small grain farming. The shifts in size distribution for dairy reflect the expected significant impact of biotechnologies.

The comparisons of the projected national size distribution of farms under scenario one with current farm structure in the Cornbelt suggest size distributions with the other two policy scenarios will over state grain farm concentration in the Cornbelt and be somewhat more accurate for the future structure of Midwest dairy farms. Hidden in the distribution proportions is the expectation that dairy farming will be

Table 20. Three Different Scenarios, Year 2000 Size Distribution of Grain and Dairy Farms, United States.

Dollar Sales Category (annual)	Scenario 1 Grain	Scenario 1 Dairy	Scenario 2 Grain	Scenario 2 Dairy	Scenario 3 Grain	Scenario 3 Dairy
	-Size Distribution-					
	-Percent-					
Less than $20,000	28.6	38.0	38.2	44.4	28.6	38.0
$20,000 to $99,999	38.4	25.6	28.8	19.2	44.6	31.3
$100,000 to $499,999	24.7	22.9	12.3	11.5	20.6	20.6
$500,000 and over	8.3	13.5	20.7	24.9	6.2	10.1

Scenario 1: Markov Chain projection (current policy)

Scenario 2: Policies implemented to speed move to bi-modal size distribution.

Scenario 3: Policies implemented to slow trend to larger size.

Source: OTA, 1985, mimeo.

Table 21. Size Distribution of Grain and Dairy Farms for U.S. in 2000 and Cornbelt in 1978.*

Dollar Sales Category (annual)	Grain		Dairy		Mixed	
	U.S.	Cornbelt	U.S.	Cornbelt	All U.S.	Cornbelt
	---------Percent--------					
Less than $20,000	28.6	37.5	38.0	47.8	51.3	45.4
$20,000 to $99,000	38.4	46.3	25.6	46.7	29.1	42.6
$100,000 and over	33.0	16.2	36.4	5.5	19.6	12.2

* U.S. 2000 size distribution is OTA's Scenario 1, which is a markov chain projection under current policies. The $100,000 to $499,999 sales category is added to the $500,000 and over category for the comparison because of 1978 data limitations.

of less importance in the Cornbelt in 2000 than today with the relatively few remaining very large dairy operations being located in Wisconsin and supplying the fluid milk markets in the region. As indicated, this is a continuation of the regional concentration of dairying in the south and west.

The continued concentration of grain farming in the Cornbelt is expected to be characterized by more large sized family farms with limited growth in super, industrialized farming operations in which there is not the embodyment of management and most of the labor in a family unit. The fmaily units may include more than one generation and may be legally organized on something other than single proprietorships. Economic circumstances, historical settlement patterns and current fragmented landownership suggests capital ownership, particularly land, will be more and more external to operating units with resources being controlled through lease arrangements.

The evidence from the 1970s suggests the use of hired labor in the Cornbelt will continue to grow with farm expansion. However, the use of hired labor will generally be supplemental to family provided labor/management resources and complementary to the mechanization of crop farming in the Cornbelt. Trends in labor substituting technology will continue requiring human capital investments in intra and extra family labor for optimal productivity. The operation of $100,000 plus field equipment is a skilled taks that will never be left to supplemental, untrained farm laborers. Nonfamily hired labor is not expected to be significant in the Cornbelt in the upcoming decade.

IMPACTS ON RURAL COMMUNITIES

From the material presented so far a number of observations can be made on the impacts of changes in the structure of agriculture on rural communities in the Cornbelt. The agricultural communities that are included in the analysis contain about half the agricultural sector in the Midwest, but only one-eighth of the population of the Cornbelt region. Even assuming that technological changes would impact the grain, dairy or mixed sectors of the industry all at the same time, a somewhat unlikely event, the impact on many regions of the Cornbelt, especially the eastern states will be quite modest.

The data also provide evidence, albeit sketchy, that for communities the greater concentration in agriculture is not found to be associated with deteriorating community well-being.

The alternative futures represented by the three scenarios presented do not appear to foreshadow negative community impacts of a substantial nature in the Cornbelt. Scenarios one and two both see the continuation of present trends toward greater concentration of farming resources in agriculture. As noted, the Cornbelt appears to lag the trends at the national level towards concentration for grain and mixed farming areas and, in particular, for dairy areas when compared to both the scenarios based on the continuation of present trends (Scenarios 1 and 2). Since documentation of aggregate negative consequences of recent movements toward higher concentration in agriculture was not provided in the cross-sectional county level analyses, these scenarios do not appear to be associated with future problems in the Cornbelt, especially when taking into account that farm concentration in Cornbelt counties is at lower levels than may be the case in grain regions of the plains and west.

The mixed agricultural counties in the Cornbelt appear to be very similar in their historical experiences to the region's grain counties. Both scenarios 1 and 2 foresee a very drastic change in the size distribution of dairy farms. These outcomes reflect the national trends in the industry rather than the current situation in the dairy counties in the Midwest (read: Wisconsin). If the Cornbelt dairy areas are to follow national trends, substantial changes will occur in the Midwest dairy farm. Again on a regional basis, the changes in the dairy industry appear to be of minor consequence, but certain Wisconsin communities will likely undergo drastic restructuring. However, the analyses of secondary data also indicate that in the dairy counties of the Cornbelt other socioeconomic forces, such as population growth, have been present which will likely mitigate the consequences of drastic reductions in numbers of dairy farms.

Technological change in agriculture is endemic. It provides new opportunities for some families, and causes serious hardships for others. Local communities will see the impacts of changes in agriculture, although in many instances such changes will be mitigated or aggreated by other local developments. If a decrease in farm numbers and maybe even agricultural activity were to coincide with a cyclical downturn in the economy, local impact could be serious in selected communities. However, for most of the communities in the Cornbelt and for the region as a whole, changes in the structure of farming will be masked by larger regional, national and international developments.

POLICY ALTERNATIVES

The limited analyses of the Cornbelt suggests that extensive negative impacts on rural communities from the continued concentration of farms into more large family farm units is not likely over the remainder of this century. This conclusion does not imply that a vibrant agriculture sector is not vital for the well-being of Midwest rural economies, but that continued reorganization of agricultural resources in more large operating units will not be economically or socially devastating , on average, to the rural regions of the Cornbelt.

Greater concentration in Midwest farming does not imply very large industrialized operating units characterized by a separation of mangement and labor and extensive reliance on investor capital. Industrial farming systems, now found in the Southwest and Western regions, are not expected to characterize the grain and grain/livestock agriculture in the Midwest in 2000.

The implications of structural changes in agriculture, driven by technology, market forces, international trade and other factors, will not be homogeneous among rural areas in the Cornbelt. The implications for the more agriculturally dependent areas in the western reaches of Missouri, Iowa and Minnesota will be different than for the economically diverse areas of Ohio.

The overshadowing of the impact of farm structure changes on the well-being of most areas of the Cornbelt by more global socio-economic forces, does not imply there will not be costs associated with the continuing evolution to a more concentrated Cornbelt agriculture. Because of the relative economic role of agriculture, the implications of these costs, which begin at the farm level and work through community and regional economics, will vary geographically. Overall economic conditions and the particulars of the agricultural economy will: 1) impact the rate of structural change in Cornbelt farming and 2) the severity of the adjustments associated with evolving farm structure change. Some communities such as the areas very dependent on dairy, will be most impacted by expected technological changes. In general, the heavily dependent dairy communities are few and concentrated in Wisconsin. From a regional perspective, the transition of the dairy industry can be viewed as a minor event, but for particular communities substantial readjustment may be necessary.

The implications of these findings for public policy are varied, but two factors are evident: 1) income support policies through feed grains, wheat and dairy commodity programs will impact the rate of technology-induced structural changes in Cornbelt agriculture, but not the general trends toward concentration. Agricultural policy alternatives such as limiting benefit payments, targeting on selected farm groups, high loan rates or price supports are instruments of income maintenance policy in agriculture but they address only directly the issues brought about by technological change in agriculture; 2) Policies to minimize the stress of the structural changes should be individual and household based and not community based; 3) To deal with the problems of rural communities will require a direct community development approach. Interest in healthy, growing rural economies extends beyond concerns for farmers and how the resources of agriculture are organized into operating firms. There is, however, some reciprocity. A diverse rural economy with competitive, close-at-hand, economic alternatives softens the costs imposed by structural changes in farming for farmers and farm families.

The policy alternatives to address the implications of farm consolidation trends on rural communities address: 1) the human problem of transition out of farming and 2) the more general concern for balanced economic opportunities, geographically.

Individual/Family Focused Policies

Technology induced changes in the agriculture of the Cornbelt will force farm families to leave agriculture. Both individuals and families need to be provided with opportunities to achieve the most efficient transition. Both exit from the farm and entrance in an alternative living and working environment can be facilitated by providing families with information and guidance. Programs for farmers and their families making the adjustment out of farming need to be targeted and transitional avoiding developing long-term dependency. The character of these programs (job training, income maintenance, counseling) would basically be no different than other programs targeted at the structural unemployment problems of other sectors. The geographically diversed nature of the client challenges the efficient functioning of the programs. Programs will need to be developed to rely heavily on locally existing resources both in the private and in the public sector. Existing institutions such as the school system, and the Cooperative Extension Service will need to be provided with resources to deal specifically with transition problems.

Geographically Balanced Economic Growth/Development Opportunity Policies

Policies aimed at encouraging equatible opportunities for economic development and diversity must recognize the inequities emanating from spatial and climatic barriers. A major contributor to the evolution of diversity in rural Cornbelt economies was the public investments in transportation infrastructure and other public capital assets in the

1960s and 1970s. As a prerequisit to economic change, infrastructure assets provide the opportunity for equal access to economic diversity and strength.

Overshadowing prerequisites for policies fostering geographically balanced ecnomic development opportunities are effective, appropriate monitary and fiscal policies, restructuring of the federal income tax code and international trade policies. The stress in the Cornbelt from agriculture problems is compounded by the decline in the international competitiveness of traditional "trade good" manufacturing industries that provide a significant part of the nonfarm economic base in the Midwest. Their relative international competitiveness is associated with monitary and fiscal policies of the federal government.

If the local rural economy cannot generate employment for members of farm families who no longer derive their livelihood from agriculture, the communities will either see a noticeable rise in their local population at or near the poverty level, or as has happened in the past, those families will leave the rural areas. Migrants potentially contribute to employment and social problems in the areas they move to, and the migration process leaves the rural community with a smaller and sometimes demographically distorted population base.

Adjustment problems of the rural economy, based on changes in agricultural structure, will be experienced more strongly in those communities with a higher level of dependence on agriculture. For the Cornbelt this indicates that community development programs ought to be concentrated more heavily in the dairy counties and in the area of the Cornbelt west of the Mississippi.

There has been some evidence (Farmline, 1985) that the employment and demographic gains the rural areas experienced in the 1960s and 1970s have been reversed in the 1980s. A rural development policy which addresses the needs of all rural areas will go far in assisting rural communities in dealing specifically with the problems resulting from structural changes in agriculture.

REFERENCES

Binswanger, Hans P.

1978 "Measured Biases of Technical Change: The United States." In H. P. Brinswanger et al., eds. Induced Innovation, Baltimore, MD: Johns Hopkins Press.

Braschler, Curtus and John Kuehn

1976 "Differential Employment Multipliers for Nonmetropolitan Counties." Southern Journal of Agricultural Economics 8:187-192.

Crecink, John C.

1979 Families With Farm Income, Their Income, Income Distribution and Income Sources. Washington, D.C.: ESCS, USDA.

Farmline (Martinez, Doug)

1985 "Farm Policy Shifts: Trouble for Rural Counties?" Farmline 6(3):14-15.

Farmline (Martinez, Doug)

1985 "The Boom Has Faded, and Many Rural Areas Lag Behind." Farmline 6(3):12-13.

Fass, R. C., David Holland and Douglas Young

1981 "Variation in Farm Size, Irrigation Technology and After-Tax Income: Implications for Local Economic Development." Land Economics 57:213-220.

Goldschmidt, Walter

1978 As You Sow: Three Studies in the Social Consequences of Agribusiness. Montclair, NJ: Allanheld, Osmun and Co.

Heady, Earl O. and Steven T. Sonka

1975 Farm-Size Structure and Off-Farm Income and Employment Generation in the North Central Region. Ames, IA: North Central Regional Center for Rural Development, Iowa State University (February).

Kessler, Ronald C. and David F. Freenberg

1981 Linear Panel Analysis: Models of Quantitative Change. New York, NY: Academic Press.

Lu, Yao-Chi

1979 "Technological Change and Structure." In Structure Issues of American Agriculture, Washington, D.C.: ESCS, USDA: 121-127.

Marousek, Gerald

1979 "Farm Size and Rural Communities: Some Economic Relations." Southern Journal of Agricultural Economics 11:57-61.

Office of Technology Assessment (OTA)

1985 Technology, Public Policy, and the Changing Structure of American Agriculture, Draft Report, Washington, D.C.: U.S. Congress (February).

Penn, I. B.

1979 "The Structure of Agriculture: An Overview of the Issue." In Structure Issues of American Agriculture, Washington, D.C.: ESCS, USDA:2-23.

Rogers, Everett M.

1983 Diffusion of Innovations. New York, NY: The Free Press.

Sonka, Steven T. and Earl O. Heady

1974 American Farm-Size Structure in Relation to Income and Employment Opportunities of Farms, Rural Communities and Other Sectors. CARD Report 48, Ames, IA: Center for Agricultural and Rural Development, Iowa State University.

Tweeten, Luther, et al.

1980 Structure of Agriculture and Information Needs Regarding Small Farms. Washington, D.C.: The National Rural Center.

Tweeten, Luther

1984 Causes and Consequences of Structural Change in the Farming Industry. Washington, D.C.: National Planning Association.

Westgren, Randall E., John Braden, David L. Chicoine, and Bartlett Eleveld

1983 Structure of Illinois Food Economy: Resource Issues. Doc. No. 83/28, Springfield, IL: Illinois Department of Energy and Natural Resources.